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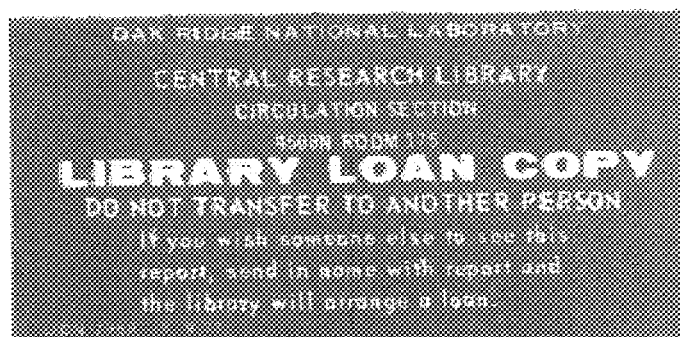
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Bibliography of Ceramic Extrusion and Plasticity



Prepared for
U.S. Department of Energy
Assistant Secretary for Conservation and Renewable Energy
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Waste Energy Recovery Program

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Metals and Ceramics Division

**BIBLIOGRAPHY OF CERAMIC
EXTRUSION AND PLASTICITY**

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ABSTRACT

A comprehensive bibliography of ceramic extrusion and plasticity has been compiled. Over 670 abstracts are included covering the period 1932 to 1984. Citations cover a wide range of interests from basic science investigations to engineering "tips" and include references to brick and tile, whitewares, technical ceramics, theoretical models, engineering analyses, forming, drying, and raw materials. In addition to the citations, there are numerous indices to make the bibliography easy to use.

INTRODUCTION

This survey of the literature of ceramic extrusion and plasticity was conducted as part of an investigation regarding extrusion and forming of ceramics for heat exchanger tubes and tube connectors such as "U"-tubes, "T"s, "Y"s, and headers. This bibliography began as an internal document solely for use in this project. However, as the number of pertinent articles identified increased beyond 100, it was decided that a formal bibliography should be compiled. Furthermore, because many of the articles were in foreign language journals, it was decided that the abstracts should be included along with the bibliographic citations.

One often hears the comment from ceramic engineers and scientists that "there is no work published on ceramic processing." Indeed, this was often our contention prior to compiling this bibliography. We have found, however, that this is certainly not true in the case of extrusion and plasticity and probably not true in general. However, one must search to find the articles of interest. This bibliography contains 672 abstracts relating to extrusion and plasticity. The time span covered is from 1932 to 1984 (the last year for which we had an annual index to the *British Ceramic Abstracts*). Half of the included articles have been published since 1970. Thus, many recent investigations on extrusion and plasticity have been published, and our original thesis regarding the lack of literature on ceramic processing is not true.

The bibliography is designed to serve as background and resource material for a wide range of interests. Articles concerning extremely basic science questions are cited, but so are articles dealing with quite practical manufacturing engineering tips. Areas of interest include, among others, brick and tile, catalysts, clay, drying, extruder design and analysis, plasticity, technical ceramics, testing methods, theoretical models, and whitewares.

The bibliography is based on a combination of a hand search through *British Ceramic Abstracts* (1932 to 1984) and a computer search of *Chemical Abstracts* (1968 to 1985). As with all searches of this type, the success of the search depends on the choice of appropriate search terms. This task was further complicated in this project because of changes in terminology with time and the use of terms that have different meanings in the European and American communities. The following terms are among those used in selecting abstracts for the bibliography:

alumina	forming	pugging
auger	laminations	raw materials
brick	lubricants	rheology
catalyst	mixing	shaping
clay	molding	strain
consistency	mulling	strength
dies	pipe	stress
drying	plasticity	structural ceramics
extrusion	preparation	tile
extruders	porcelain	viscosity
flow	pug mill	whitewares

After initial identification, the abstracts were examined to determine their appropriateness for inclusion in the bibliography. Most of the search was conducted manually, and several different people were involved in the search. Because of these factors, it is possible, even probable, that some references to extrusion and plasticity were not included that should have been included. Therefore, we do not claim that this is an authoritative list of all applicable references. However, using this bibliography, one should be able to make a start at researching most aspects of ceramic extrusion and plasticity.

The bibliography consists of six sections: (1) Citations and Abstracts, (2) Author Index, (3) Title Index, (4) Key Title Phrases Index, (5) Journals Cited Index, and (6) Patent Number Index.

The abstracts are arranged by year, starting with 1932. Within each year, they are arranged alphabetically by author. The indices were chosen to make using the bibliography as easy as possible. The Key Title Phrase Index was chosen as the subject index because keywords were not available for most of the abstracts and because generating keywords for each abstract would have been a monumental undertaking.

In assembling the bibliography, we identified several notable authors and notable articles. Among the American authors, we recognize such familiar names as Norton, Robinson, Russell, and Williamson. We also identified several notable European and British authors, among them Astbury, Bloor, Coulhon, Dale, Goodson, Macey, Pels Leusden, and H. Schmidt. In particular, Pels Leusden and H. Schmidt have been exceptionally prolific in the German literature of plasticity and extrusion of clay bodies.

Several excellent series articles were identified. Among these are (1) Dale's 24-part "Modern Ceramic Practice" [180],* (2) Fearn's 5-part "Cracked Bricks" [131-135], (3) Filippi's "Lamination in Clay Extrusion" [588-590, 618], (4) Henicke's "Organic Plasticizers for Fine Ceramics" [556, 557], (5) Macey's "Experiments on Plasticity" [30, 45, 46], (6) Pels Leusden's "Shaping by Extruders" [513, 529, 530], (7) H. Schmidt's two long series "Methods of Studying Heavy-Clay Raw Materials" [355] and "Physical and Chemical Methods of Investigation in the Heavy-Clay Industry" [572], and (8) Whitaker's 10-part "Design and Correction of Dies" [31-36, 40].

In reviewing and editing the bibliography, we discovered a number of interesting, and sometimes intriguing, articles. For example, in 1939, T.C. Vaughn and coworkers [17] showed that *ultrahigh frequency electrical drying* (i.e., microwave) could be used to successfully dry complicated and difficult-to-dry clay bodies. In 1936, Brenntrop [4] introduced the concept of *steam preparation* of heavy clay, an industry standard today. Norton [15] investigated the properties of *monosized particles* (of clay) in 1938, a current topic of intense interest for technical oxide, carbide, and nitride particles.

Tarpley et al. [194] described the use of *ultrasonics* to aid the extrusion of various oxide ceramics (alumina, magnesia, titania); Nakhamkin [349] discussed shaping plastic porcelain using ultrasonic vibrations; and Larson [441] examined the effects of both low frequency and ultrasonic vibrations on sedimentation; all three of these studies demonstrated the benefits of vibration assist in plastic processing. Several investigations cited the use of *multilayer extrusion* [296, 439, 544, 610] to extend poor raw materials, to cut cost of expensive facing materials, and generally to form dual structures.

*Numbers in brackets refer to the abstract number.

Extrusion of 36 to 48 inch clay pipe is described in Oberschmidt's 1968 article [309]. Corning's *honeycomb catalyst support* [517] is also included. The catalyst literature was identified as a useful source of extrusion information; eleven entries are found in the Key Title Phrase Index under *catalysts*. Several comprehensive surveys were identified; among these are Bloor's assessment of *plasticity* [128], Condamy's *drying* survey [414], and an international review of extrusion equipment [434]. Interest in the application of *soil mechanics* test methods and theories has surfaced since 1969; at least 11 articles dealing with various aspects of ceramics, or clays, and soil mechanics were identified [327, 330, 371, 472, 548, 580, 581, 583, 615, 646, 671]. The use of *electroosmosis* in the drying of large (500-kg) refractory blocks reduced drying time from >200 h to ~15 h [446]. A detailed *analysis of extrusion* of plastic and visco-plastic solids is described by Zienkiewicz [451]. *Holographic non-destructive evaluation* of wet clay bodies identified discontinuities or disturbances that became cracks after drying [632].

We acknowledge the help and kindness of the British Ceramic Research Association for allowing us to publish, without cost, the abstracts taken from *British Ceramic Abstracts*. Furthermore, we acknowledge T.N. Tiegs and R.A. Lowden for review of the manuscript and F.W. Burns, J. Cooper, and J. Scott for document preparation.

1932 Documents

1

Navias, L.

**Extrusion of Refractory Oxide Insulators
for Vacuum Tubes (Valves)**

J. Am. Ceram. Soc. 16, 234

The special requirements of refractory insulators for the radio valve industry are outlined. The

process of making such insulators of MgO , Al_2O_3 , BeO , ZrO_2 , and ThO_2 is described, including the processing of the raw material, plastic agents, extrusion methods, and firing. The plastic agent used contained 14% flour, 79% water, and 7% concentrated ammonia. 2% of talc were added to the MgO powder. (BCA)

1934 Documents

2

Stull, R.T.

Wear of Dies for Extruding Plastic Clay

Bur. Standards J. Research 12, 501

A study was made of dies of 20 metals and alloys and of porcelain to determine their relative resistance to wear by a plastic clay-sand mixture (No. 1). The approximate angle of constant wear rate was determined for the dies used. Further, tests were made on one die material to find the relative abrasive intensities of a plastic porcelain body (No. 2) and clay No. 1. A constant volume of the abrasive material in the stiff mud condition was extruded from the dies at a constant volume rate, and their wear losses were determined. Vicker's hardness numbers of the specimens were also determined. The angle of constant wear rate was found to be approximately 3.53°. The relative service values ranged from 3.22 for a soft brass to 1,653 for an alloy composed of cobalt, chromium and tungsten. The wear resistance of porcelain decreased asymptotically with depth, while that of nitrided steel varied irregularly as successive layers of the case were removed by abrasion. No relation was found between service values and Vickers' numbers for unlike materials, but there was, in general, a direct relation for materials of the same kind. The relative wear loss for a given material is equal to the 1.548th power of the extrusion pressure divided by a constant. (BCA)

3

Westman, A.E.R.

The Effect of Mechanical Pressure on the Drying and Firing Properties of Typical**Ceramic Bodies**

J. Am. Ceram. Soc. 17, 128

In the experiments described, a larger press was used than in the two previous series (cf Trans. Brit. Ceram. Soc. 32, 2A and 60A, 1933). Specimen discs 2-3/4 in. diameter and up to 1-1/2 in. thick could be pressed in order to study rates of pressing and to detect possible drying and firing difficulties. Tests were made on typical bodies for chemical stoneware, sewer pipes, glass pots, sanitary ware, electrical porcelain, and semi-vitreous ware. American, English, and German clays were used. A pressure of 8,280 lb/in.² was applied to the specimens in a press with water-permeable pistons described in the previous papers. The rate of pressing depended to a great degree on the nature of the material. In all cases, the initial rate was rapid but fell off with time. The time of pressing varied roughly with the square of the initial thickness. Permeable pressing eliminated drying shrinkage in all bodies and caused a slight expansion in one case. Most of the specimens were dried and fired successfully, but some cracked due to thermal shock. Permeable pressing reduced the firing shrinkage by nearly one-half, and the total wet-to-fired by from one-half to two-thirds. It also reduced the closed pore volume. With normally open-firing bodies, the pressing decreased the fired porosity and so had less effect on the firing shrinkage. The permeable-pressed glass pot disc showed a total linear wet-to-fired change of only 1.5% or less. With the sewer pipe and chemical stoneware bodies, the pressed discs, owing to denser structure, required longer oxidation and reducing periods than unpressed discs. (BCA)

1936 Documents

4

Brenntröpp, H.

Preparation of Brick Clay with Steam

Tonind. Ztg. 60, 49

Experiments were carried out with a difficult clay, and it was found that by applying heat (steam or hot water) during the preparation process a harmless clay can be produced from one which is normally difficult to work and sensitive in drying. (BCA)

5

Ricke, R. and L. Tscheischwili

The Viscosity of Kaolin and Clay Suspensions Measured with Different Viscosimeters, and the Effect upon It of Different Methods of Treating the Materials

Ber. Dtsch. Keram. Ges. 17, 1

A series of kaolins and clays was examined by different types of viscosimeters to determine their suitability for practical purposes and to compare the results obtained by the different methods. The influence of ageing, temperature, and the presence of different cations on the viscosity was also studied. With the Bingham viscosimeter it was found that the pressure-flow curves gave straight-line relationships only with almost non-plastic materials, e.g., some glazes and at low concentrations; with kaolins and clays crooked curves were always obtained, which, according to Wo. Ostwald, is due to a "structural viscosity." This fact necessitated a different method of dealing with the results. Bingham's yield-value was obtained by extrapolation of the curves to the point of intersection with the abscissa axes. The "mobility" (after Bingham) was expressed by the ratio b/a , in which, for the sake of simplicity, $a = 10$ mm always and was measured from the point of intersection; b is then the ordinate of the point lying on the chord connecting the point of intersection and the starting-point of the curve. In general the a -values increase and the b -values decrease with rising plasticity. For each material there is a definite NaOH-addition which gives a straight-line relationship when the yield-value

= 0. Ageing produced an increase or decrease in viscosity, depending on the nature of the raw materials; the effect of temperature was comparatively small. The effect of NH_4 , K, and Na on Zettlitz kaolin suspensions was very marked, particularly the first two, causing a considerable reduction in viscosity. (BCA)

6

Wilson, E.O.

The Plasticity of Finely Ground Minerals with Water

J. Am. Ceram. Soc. 19, 115

The relation of plasticity to the shape and nature of the particles was studied on a variety of minerals of different structures. A torsion machine for testing plasticity is described in which a bar of clay is mounted in jaws and twisted at the rate of 3-4 rpm. The stress-strain curve is traced on a smoked glass plate. The results indicate that the plasticity of finely ground minerals with water is due to the presence of stable viscous water films held on the surface of the particles. The formation of such films depends on the shape and surface activity of the particles. Minerals with a perfect cleavage have a higher plasticity than those without. In general, minerals having a plate-like structure are more plastic than those with a perfect cleavage in some other crystal form. The clay minerals are more plastic than other minerals having a plate-like structure, due to greater surface activity. The OH group on the surface of the kaolin minerals may be the cause of this great surface activity. Minerals having one predominant cleavage show some plasticity over a very limited range of water-content. Minerals having no definite cleavage have no plasticity. The stress-strain diagrams are suitable for the study and interpretation of the plastic properties of mineral-water pastes. The stability of the water films is proportional to the height of the yield-point on such diagrams. The total deformability is proportional to the angular strain at fracture. Plasticity is roughly proportional to the product of the yield value and the angular strain at fracture. (BCA)

1937 Documents

7

Gerth, G.

The Preparation of the Most Important Ceramic Raw Materials

Ber. Dtsch. Keram. Ges. 18, 65

Methods of preparation are divided into five groups: preparation by sorting and picking; by sieving, washing, etc.; by flotation; by magnetic separators; and by centrifuges. These are briefly described. A discussion then follows of the methods applicable to the preparation of clays, kaolins and chalk; felspars, quartz fluorspar, and magnesite. (BCA)

8

Henderson, C.H.

Die Design Corrects Lamination

Brick Clay Rec. 90, 329

The various types of laminations are discussed, and suggestions are made for correcting them. The physical properties of the clay have a direct bearing on the type of lamination produced. Fat or very plastic clays are most susceptible. In the specific case discussed, the clay was a very plastic fireclay with a total shrinkage of about 10.5%, which showed a very pronounced tendency toward laminations. Trials were made with eight different dies, six augers differing as to taper, pitch, number of wings, and metal, two different auger machines, de-aired and untreated clay, several auger speeds, various spacings between auger and die, a number of coring arrangements, lubrication of dies by steam, air, oil, and water, and many combinations of these. No solution was found until a special die was designed. This had the following characteristics: total length, 8-3/4 in.; length of mouth piece, 2 in.; taper of ends, 0.5%; taper of top and bottom at corners, 0.65%; taper of top and bottom at centre, 5.25%; allowance for swell 1/32 to 1/8, depending on the clay. (BCA)

9

Macey, H.H.

The Principles Underlying the Drying of Clay

Refract. J. 13, 423

Revised reprint from Trans. Brit. Ceram. Soc., 33, 92, 1934.

(Abstract not available.) (BCA)

10

Schurecht, H.G., and C.M. Lampman

Some Drying Properties of Clays. I. Effect of Small Imposed Loads on the Rate of Drying of Some Clays

J. Am. Ceram. Soc. 20, 266

The materials studied were Kentucky ball clay, a shale, and Georgia kaolin. The rates of drying of these representative clays were studied under pressures comparable with those encountered in industrial practice in the lower portions of large shapes and in drying truck settings. The results indicate that: low pressures on clays or clay products during drying increase the rate of drying, the increase varying with different clays, being less for extremely plastic than for short clays; with the kaolin, the rate of drying was increased as much as 58% under a load of 1.56 lb per in.². Unloaded specimens contained 1.34 to 3.30 times as much water as loaded specimens. Thus a new fundamental factor is introduced into drying, in addition to the diffusion of water from the interior of a clay piece to the surface and the rate of evaporation of water from the surface. (BCA)

11

Schurecht, H.G., and C.M. Lampman

Some Drying Properties of Clays. II. Effect of Small Imposed Loads on Shrinkage Behaviour and Plastic Properties of Some Clays

J. Am. Ceram. Soc. 20, 270

Five clays and one talc were tested. It was found that small pressures during drying cause variations in (1) the amount of plastic deformation, (2) the retardation during shrinkage, (3) tensile strength during drying, (4) tensile strength required to overcome the retarding effects of shrinkage, (5) amount of initial retardation, and (6) rate of shrinkage. All these factors may con-

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tribute to the formation of strains and cracks in ware dried under load. In the plastic state, clays showed two yield values under pressure, an initial flow, and a second flow at higher pressures. The tensile strength of Kentucky ball clay during drying was found to be a linear function of its water content down to about 4%. (BCA)

12

Schurecht, H.G., and C.M. Lampman

Some Drying Properties of Clays. III. Influence of Pallets on the Quality of Clay Products

J. Am. Ceram. Soc. 20, 277

The influence of six different drying surfaces on the shrinkage and strength of clays was studied. The results apply chiefly to those portions of large shapes in contact with the pallets and in the lower courses of drying truck settings of considerable height. The resistance of surfaces on which ware is drying to the creeping of the ware while shrinking may decrease the shrinkage and strength of the ware to a marked extent. This reduction is much greater for lean than for plastic clays, and these effects are greater when the ware is dried under pressure. Glass surfaces offer the greatest resistance to shrinkage, and steel pallets are only slightly better. Smooth firwood pallets along the grain of the wood offer the least resistance to shrinkage. Covering steel pallets with sand, grog, cardboard, or grease was beneficial as regards the strength of the specimens, but grease caused excessive surface cracking. (BCA)

13

Simin, W.N.

New Methods of Drying

Ogneupory 3, 384

It follows from theoretical considerations that as long as the water content is high the capillaries are full of water, and evaporation can take place only at the surface of the body. Heat is therefore consumed only at the surface. This heat can be applied in various ways, e.g., the body can be heated only from one side, when evaporation takes place from the opposite side, since the

moist body is a good conductor of heat. In this case there is a flow of heat in the direction of the evaporation, which causes a heat gradient through the body. This type of drying is said to be by "thermal diffusion." The heat can also be applied by making use of the sufficiently high electrical conductivity of the moist body; a tension gradient is produced in the body, thus causing it to be warmed up. AC current must be used. The relationship between coefficient of thermal expansion and temperature gradient in the body was studied. A wet brick was heated at the bottom, the top being protected against loss of water and the sides against water and heat losses. With a temperature of 48.3 degrees at the bottom and 41.8 degrees at the top the moisture gradient was 0.71%. This agreed well with a moisture gradient of 0.69% calculated from the relation between capillarity and temperature. In general, drying is accelerated more when a temperature gradient is present in the body than when the moisture is taken up only by air circulation. The method was applied to the drying of glass pots, which were heated from the inside. For a drying period of 20-23 days and a moisture content of the body of 25%, a pot could be dried to 1.5-2% moisture content with a heat consumption of 1,100-1,300 calories per kg water. The current required for the heating was only 1-2 amps for a pot of 1 tonne capacity. The temperature gradient produced in the walls of the pot was never more than 3 degrees per cm. It is shown theoretically that if the temperature and humidity of the air are constant, the rate of water removal depends only on the temperature gradient and not on the thickness of the body. In the "electro-diffusion" method of drying, metal rings are used as electrodes and are fixed round the edge of the pot and near the bottom, while a further ring-shaped electrode is placed inside the pot near the bottom. The electrical resistance of the body increases steadily with decreasing moisture content. Theoretical curves, which were confirmed experimentally, are given showing the relationship between rate of water removal and tension gradient in the body. For an air temperature of 27 degrees and a water content of 40%, a body thickness of 3 cm and a tension gradient of

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1 volt per cm, the rate of water removal was 120 gm per m² per hour; for a gradient of 3 volts it was 300 gm, and for 5 volts, 750 gm. Comparing the two methods of drying--by thermal and by electro-diffusion--it is pointed out that drying by electro-diffusion is technically easier to carry out, the surface exposed for moisture removal is greater, and the process is largely automatic, since, owing to the increasing resistance of the

drying body, it finally stops of itself. The thermal diffusion method has the advantage when the moisture content of the body is low and the electrical resistance has consequently greatly increased; it might therefore be preferable to apply electro-diffusion during the preliminary period of drying and thermal diffusion during the final stages. (BCA)

1938 Documents

14

Norton, F.H.

An Instrument for Measuring the Workability of Clays

J. Am. Ceram. Soc. 21, 33

In the test described the specimen consists of a tube 5/8 in. inside and 7/8 in. outside diameter, with a length between the holders of 2 in. The specimens are formed in a vacuum press extruding downwards. The test-pieces are carefully inserted into square brass end-pieces, so that they can be securely clamped in the torsion head of the testing machine. The torsion head is rotated by a motor through reduction gear, etc. The angle of rotation of the specimen is recorded by a steel tape, suitably attached, and the angular rotation is proportional to the movement of a smoked plate, which is illuminated from the back. The method of making a test is described. Results for different clays are given in tables and curves. Most clays give a diagram typical of an elasto-plastic solid, an initial portion up to the yield-point representing the elastic region and the portion between the yield-point and the breaking-point indicating plastic deformation. Some clays give a curve which indicates a definite yield-point with an actual decrease of strength at that point, similar to metals when tested in torsion. The reduction in strength is attributed to thixotropy and the subsequent increase in strength to strain hardening. Some coarse-grained china clays show the strain-hardening effect markedly. At least three properties must be used to express workability, viz., yield-point, maximum strength, and deformation at the breaking-point. In comparing two clays their various characteristics must be determined at several water contents, in order to select that water content which gives best workability. (BCA)

15

Norton, F.H., and S. Speil

The Fractionation of a Clay into Closely Monodispersed Systems

J. Am. Ceram. Soc. 21, 367

Advantages of studying a clay by dividing it into nearly monodispersed systems include: the relation between the grain size and physical properties can be closely evaluated; the optimum grain size for a particular purpose can be readily chosen; the clay minerals and accessory minerals can be determined readily; helpful data become available for planning methods of washing. The method of fractionating is described, using a Florida kaolin. Particles above one micron were separated by repeated settlings, and the finer sizes were treated in a Sharples supercentrifuge. (BCA)

16

Norton, F.H., and S. Speil

The Measurement of Particle Sizes in Clays

J. Am. Ceram. Soc. 21, 89

The literature of the subject is first reviewed. A simple method is described for measuring the complete range of particle sizes in a clay with apparatus suitable for a plant-control laboratory. The Casagrande hydrometer method was applied; when the particles above 2 microns diameter had settled below the hydrometer bulb, the suspension in the same vessel was slowly revolved in a centrifuge. After a short period the machine was stopped, a reading was taken, and the speed of the centrifuge was increased by steps, with readings between each step, until a speed of 6000 rpm was reached. This speed was maintained until all the measurable particles were sedimented out of the suspension. The method permits, with one suspension and one instrument, the continuous measurement of sizes from 30 microns down to 0.05 micron diameter. Distribution curves are given for several types of clay, and the accuracy of the results is discussed. (BCA)

1939 Documents

17

Vaughan, T.C., H.E. Revercomb, and W.A. Murray, et al.

Drying Ceramic Products Using Induced Ultra-High-Frequency Electrical Energy

J. Am. Ceram. Soc. 22, 281

Ideal drying conditions for clayware would be to heat the piece at the centre first and maintain the temperature at the centre higher than at the outside. An investigation was therefore carried out to determine the possibilities of drying by heating ware from the centre outwards by ultrahigh frequency induced electrical energy. The construction of the laboratory dryer and of the electrical oscillator is described. The clay used was a fine-grained, alluvial-type clay with a high drying shrinkage, i.e., one not easy to dry. Test specimens were 2-1/4-in. cubes. The results show: that the time required to dry specimens by this method until shrinkage ceases is only 30% of that required when resistance-wire heating coils are used; that it is possible to dry successfully complicated shapes evenly over their cross-sections; that the structures of the pieces are not detrimentally affected by the rapid drying of this method. (BCA)

18

Whittaker, H.

Effect of Particle Size on Plasticity of Kaolinite

J. Am. Ceram. Soc. 22, 16

A Kentucky ball clay and a Georgia kaolin were resolved into seven practically monodisperse fractions ranging from 0.2 to 20.0 microns in mean size. The clays were dispersed in water with the predetermined amount of deflocculant required for stable suspensions of unit particles. The ball clay suspensions were split up into four fractions by repeated settlings under gravity for

the fraction of more than 1 micron. The three fractions under 1 micron were produced by repeated centrifuging with a Sharples super-centrifuge. The kaolin suspensions were split up into three monodisperse systems by repeated settlings for the fine fraction, and a short-column elutriator was used for the coarse fractions. The particle-size distribution curves for these fractions were obtained by a combination of the Casagrande hydrometer method with a settling and centrifuging technique developed by Norton and Speil (Trans. Brit. Ceram. Soc., 37, 18A, 1938). Plasticity, drying shrinkage, and dry strength measurements were made on the fractions. The results indicate that plasticity is directly related to surface area and inversely related to particle size. The relation of plasticity to surface area of kaolinite can be expressed by $\log S = AP + \log B$, where S = surface area per 100 grams of clay, P = product of yield and strain, and A and B are constants. Under the conditions of these tests, kaolinite exhibits plasticity only when the surface area is greater than $180 \times 10^4 \text{ cm}^2$ per 100 grams of clay, i.e., when $B = 180 \times 10^4$. Kaolinite shows the Osborne Reynolds close-packing effect when the system contains particles more than 2 microns mean spherical diameter. The thickness of water films at optimum plasticity is of the order of magnitude of 90 angstroms. When hydrogen is exchanged for the bases, the plasticity increases and the dry strength decreases. The removal of the exchangeable bases increases the water required to form a plastic mass of kaolinite. The plasticity of kaolinite is not due to a coating of colloids on the surface of the particles, but is exhibited only when the particles in the system or a significant amount of them are of colloidal dimensions. The drying shrinkage increases, in general, with decreasing particle size. The dry strength increases, in general, with decreasing particle size up to maximum, after which it decreases. (BCA)

1940 Documents

19

Speil, S.

Effect of Adsorbed Electrolytes on Properties of Monodisperse Clay-Water Systems

J. Am. Ceram. Soc. 23, 33

A sample of Florida kaolin was separated by a super-centrifuge into three nearly monodisperse systems of 0.1-0.2, 0.2-0.4, and 0.4-1.0 μ respectively. These samples were electrodialysed, and varying concentrations of sodium or barium hydroxide were added to aliquot samples of the H clay thus obtained. The base exchange capacity at pH 7 varied linearly with the surface area.

The apparent viscosity was reduced to about 4% of its original value by the addition of 1 milliequivalent of sodium hydroxide, after which further additions had a very slight lowering effect. The addition of electrolyte decreased the yield-point and increased the maximum strain before rupture at the water content of optimum plasticity. The water of plasticity, pore water, shrinkage water, and film thickness were decreased by adding electrolyte. The dry transverse strength was doubled by the change from H to Na clay. Most properties varied linearly with the surface area within the experimental error. The potential concept of plasticity is briefly outlined. (BCA)

1941 Documents

20

Ensminger, L.E., and J.E. Gieseking

The Absorption of Proteins by Montmorillonitic Clays and its Effect on Base Exchange Capacity

Soil Sci. 51, 125

Proteins considerably reduced the base exchange capacity of montmorillonite in acid suspension, but no effect was found under alkaline conditions. (BCA) Abstr. No. 393

1942 Documents

21

Henry, E.C.

Plasticity and Workability of Ball Clays

Bull. Am. Ceram. Soc. 21, 269

Methods for measuring the flow properties of ball clays in the plastic state are compared. The concepts of "workability" of interest to ceramists include (1) plastic flow properties (yield value and mobility), (2) adhesiveness (stickiness), and (3) cohesiveness (the ability to be deformed without rupturing). Ball clays probably influence the workability of a whiteware body chiefly by making it cohesive. (BCA) Abstr. No. 348

22

Macey, H.H.

Clay-Water Relationships and the Internal Mechanism of Drying

Trans. Br. Ceram. Soc. 41, 73

(Abstract not available.) (BCA) Abstr. No. 502

23

Russell, R.

Evaluation of Plastic Properties of Clay Masses

Bull. Am. Ceram. Soc. 21, 271

The factors involved in the evaluation of plastic properties of clay masses are discussed. Some of the commonly used methods of testing the plastic character of clays are described, and several adaptations of tests often used on clays are proposed for consideration. (BCA) Abstr. No. 272

24

Russell, R., and C.F. Hanks

Stress-Strain Characteristics of Plastic Clay Masses

J. Am. Ceram. Soc. 25, 16

An apparatus is described for reproducing stress-strain data, and it is concluded from investigation of the stress-strain characteristics of plastic clay masses that the plastic character depends on several physical properties, and cannot be completely evaluated by any single parameter. The

shape of stress-strain curves depends on the clay mixtures, and it is thus possible to distinguish between different compositions on the basis of their mechanical behaviour alone. "Moisture equivalent," i.e., the moisture content necessary for an arbitrarily selected equilibrium stress (5 lb per in.²) is a satisfactory parameter for the comparison of the plastic properties of clays and similar body compositions. Bodies of different non-plastic content cannot be compared by "moisture equivalent" data. Variations in moisture content have a pronounced effect on the equilibrium stress value and on plastic behaviour; ageing of china clays and bodies lowers the moisture equivalents, and an opposite effect is noted for ball clays; the ball clay of highest organic content was most affected by ageing. Ageing of ball clays and bodies resulted in a progressive change at least up to one week, whereas china clays were unaffected after ageing four hours. Cyclic loading indicates that a clay body is essentially non-elastic after being stressed to its yield point. An increase in the strain rate shows a marked effect on the stress-strain results and increases the equilibrium stress. For the evaluation of various materials or mixtures plasticity should be determined under standardised conditions. Workability depends on ageing, the use of electrolytes and organic agents, vacuum treatment and variation in water content. For a clay body of determined plasticity, the workability is said to improve in direct relationship to a decrease in moisture equivalent (increased softness) caused by the effects of special treatment and processing. (BCA) Abstr. No. 395

25

Schurecht, H.G., and J.F. McMahon

Testing and Improving the Drying Behaviour of Clays

J. Am. Ceram. Soc. 25, 422

A simple test has been developed to measure the drying behaviour of clays by noting the relative rate of flow of water through the clays as compared with the rate of evaporation from the surface. The addition of 0.2% of various chemicals to clays improved their drying properties. No

1942 Documents

one chemical was best for all of the clays, but the most effective chemicals varied in their reaction on different clays. Iron chloride exerted a beneficial effect on most of the clays. A wetting agent,

such as NaCl, HCl or soda ash, also improved the drying properties of certain clays. (BCA) Abstr. No. 146

1943 Documents

26

Furgason, C.M.

Maybe It's Bentonite in Your Clay that Makes it Hard to Handle

Brick Clay Rec. 103(3), 22

Bentonite has many characteristic properties, including great water absorption capacity, variations in dimensions of the crystals depending upon the adsorption of the planar water, and great shrinkage as the planar water is driven out from between the layers. Clays in which the bentonite content is variable may be troublesome. Its effect may be controlled either by precalcination at 600 degrees C or by preventing swelling by a base exchange process. (BCA) Abstr. No. 142

27

Haward, R.N.

The Fast and Slow Extension of Some Plastic Materials

Trans. Farad. Soc. 39, 267

It is suggested in a theoretical discussion that the work taken up by any material under impact may be governed either by the rate at which deformation can take place or by the amount of possible deformation. The results of fast and slow extension experiments are examined, and it is found that in this way apparent contradictions can be resolved. Experiments are carried out on the extension and breaking of a cellulose acetate film at different temperatures, and it is concluded that temperature changes during adiabatic extension will not be so large as to alter fundamentally the character of the deformation. The work absorption of different materials under changing conditions of testing varies both relatively and absolutely, and the validity of a

generalised impact strength is questioned. A more precise formulation of shock conditions appears desirable. (BCA) Abstr. No. 94

28

Henry, E.C.

Measurement of Workability of Ceramic Bodies for Plastic Moulding Processes

J. Am. Ceram. Soc. 26, 37

The plastic working properties of a number of clays and bodies were measured with a modified Endell body tester. The apparatus shows that various bodies may be adjusted to a similar consistency for a given moulding process, but differ in their tendency to crack on being deformed. It is possible to determine the extent to which plastic properties are affected by differences in raw materials, methods of body preparation, water content, aging, and de-airing. (BCA) Abstr. No. 418

29

Johnson, A.L.

Colloid Chemistry in Ceramics

J. Am. Ceram. Soc. 26, 88

The mechanism underlying the plasticity of clay is discussed from the standpoint of the forces in the lyosphere. If the resultant force is one of repulsion between micellae, the clay will be more easily deformed and more readily ruptured than will a clay having attraction forces at the edge of the lyosphere. Further study of this branch of colloid chemistry should lead to greater control of the plastic properties of clays and other materials. The colloid chemistry of the base exchange processes in clays has a direct bearing on the casting of clay products; the subject receives brief discussion. (BCA) Abstr. No. 511

1944 Documents**30**

Macey, H.H.

Trans. Br. Ceram. Soc. 43, 5

Experiments on Plasticity. I. and II.

(Abstract not available.) (BCA) Abstr. No. 142

1945 Documents

31

Whitaker, L.R.

The Design and Correction of Dies. I-III.

Brick Clay Rec. 106(3), 41; 106(4), 42; 106(5), 48

A list of factors affecting die operation is given, and a study is undertaken with a view to obtaining greater uniformity of results. Differences in the composition and texture of the raw material offer great difficulty, and these can be affected by the methods of mining and preparation. It is often preferable to import material to produce a uniform mixture, rather than to balance the die. The segregation of coarse and fine material during preparation is explained, and various additions for improving the quality of mixtures are given. The necessity for studying the geology and adapting the digging to the type of bed is emphasized. The methods of mining horizontal and dipped beds are outlined, with the storage suitable for various kinds of clay; a note on the apparatus for filling the storage bins is included. The effect of the particle size of a mix on the manufacturing processes is discussed, and a good screen analysis of shale is given as an example. The factors to be taken into consideration for the correct size distribution of material ground by means of dry pans, roll grinding, and hammer mills are explained. The author emphasizes the need for excess grinding capacity, and deals with the problems of obtaining a uniform mixture from the non-uniform ground materials. It is better for the circulating load to be kept at a low level to avoid wasting power, and full use should be made of machinery to reduce the manpower required. The factors which offer difficulty in the tempering of clays are explained, with possible methods of overcoming some of these; the importance of correct grinding is emphasized. The main faults of tempering and mixing machines are discussed, and the working of the pug-mill, in relation to its proportions, is dealt with in detail. (BCA) Abstr. No. 660

32

Whitaker, L.R.

The Design and Correction of Dies. IX. Auger Design Affects Clay Flow

Brick Clay Rec. 107(6), 48

In order to produce better knitting together of the layers of clay on leaving the auger, treatment of the discharge end of the main thread and wing is considered. The first method is to corrugate the end of the thread, while the second method is to level the end of the thread to a sharp edge. Bridges for hollow-ware dies should be placed in the zone of greatest pressure, i.e., adjacent to the auger, in order to produce effective knitting of the clay column after passing over the bridge bars. Various bridge designs to promote even flow and reduce bridge cracking and the location of the bridge to produce even flow of materials to the die and eliminate strains and laminations in the ware, are considered. (BCA) Abstr. No. 695

33

Whitaker, L.R.

The Design and Correction of Dies. VI. Clay Flow and Auger Action

Brick Clay Rec. 107(3), 40

The movement of clay in an auger is controlled by its temper, grain size and uniformity. Auger efficiency depends on the pitch and shape of the auger and on the grip of clay against the barrel. An illustrated account is given of an auger and barrel showing the features of design on which depends the correlated action of the clay movement by the auger. (BCA) Abstr. No. 1010

34

Whitaker, L.R.

The Design and Correction of Dies. VII. Action of Clays in the Auger

Brick Clay Rec. 107(4), 40

The development of vertical S-shaped laminations from the hole made by the auger shaft in the centre of the clay column is described. The flow lines from the auger to the die should be as uniform as possible, the clay if necessary being treated so that it slips easily on the auger but adheres strongly to itself. Small or tapered

1945 Documents

augers allow of less distorted lines of flow, but they must be worked at a sufficiently high speed to prevent the barrel becoming heated by friction. Uniform pugging is helpful in improving the extrusion properties of clays. (For Part VI, see Abs. 1010, 1945). (BCA) Abstr. No. 15

35

Whitaker, L.R.

The Design and Correction of Dies. VIII. Effects of Augers on Clay Flow

Brick Clay Rec. 107(5), 50

Clay flow is described and the design of different types of augers discussed. These include the straight auger and the double- and triple-winged auger. The control of the flow of clay behind the die involves controlling the flow by the various functions of the auger and regulating the flow by increasing the distance between the auger and the die. The introduction of oil in a circle about 1-1/2 in. from the rear end or 1-1/2 in. in front of

the auger, thus introducing oil behind the bridge, reduces the power consumption and increases the speed. The amount of rotation which occurs in the lubricated spaces is considered. (BCA) Abstr. No. 136

36

Whitaker, L.R.

The Design and Correction of Dies. IV. Chemical Treatment of Clays and Shales

Brick Clay Rec. 107(1), 50

The advantages of chemical treatment of clays and shales is noted, e.g., the addition of 0.1% sodium carbonate to a certain brick and tile clay changed a short clay to a plastic clay, increased the dry strength, and required less water to be added in the tempering operation. Research carried out on the chemical additions is briefly noted. The use of soda ash and methods for its addition are described; the use of a wetting agent with the clay is suggested. (BCA) Abstr. No. 889

1946 Documents

37

Grupelli, L.D.

Process of Moulding Ceramic Material

Patent No. U.S. US 2400001, 7 May, 1946,

In the process of moulding a moist plastic ceramic material preparatory to firing the same, wherein the moist plastic ceramic material is shaped by means of a metallic die, there is interposed between the surface of the die and the moist plastic ceramic material a lubricating film of a water-in-oil emulsion comprising mineral oil, water, and a diamide formed by reacting ethanol ethylene diamine with a substance selected from the group consisting of higher fatty acids and esters, followed by reacting the resulting monamide with a compound selected from the group consisting of lower fatty acids and their anhydrides. (BCA) Abstr. No. 817

38

McMillin, H.F., and P.C. Pocock

Extrusion Machine

Patent No. U.S. US 2411971, 3 Dec, 1946,

The machine is designed for the extrusion of plastic materials. A screw which feeds a constant quantity of materials through an extrusion die is kept in position by means of a hydraulic thrust bearing, and by a chamber and piston attached to the screw. These are so arranged that the piston and screw maintain a relatively fixed position despite torque changes which affect the screw. (BCA) Abstr. No. 218

39

Rogowsky, Z.

Mechanical Principles of the Screw Extrusion Machine

Inst. Mech. Eng. Preprint

The screw extrusion machine as used in the plastics industry is briefly described and submitted to a dimensional analysis resulting in generalised relations between, on the one hand, pressure developed, rate of discharge, and drive-power and, on the other, viscosity of plastic extruded, speed of machine, and a characteristic dimension. The velocity distribution of an assumed ideally viscous, so-called "plastic," material within the rectangular screw thread is determined, and expressions for discharge and pressure developed are derived in terms of its dimensions. These expressions are used to discuss the effect of increasing the number of "starts" on a screw. A method of rating extrusion machines is proposed so as to allow an adequate description of their capacities. (BCA) Abstr. No. 811

40

Whitaker, L.R.

The Design and Correction of Dies. X. Placement of Core Rods and Bridges

Brick Clay Rec. 108(1), 62

Suggestions are made for controlling the clay flow by the positioning of the core rods, but it is pointed out that these must be correspondingly stronger when used to divert the flow than when they are streamlined. Diagrams show various arrangements of cores on bridges, to suit different conditions of flow; it is stated that the resistance of a bridge to bending varies as the square of the span, so that it should be as strong as is compatible with the need for a narrow cross-section. The action of the clay at the cores or bridges, and the effect of the taper of the auger on the clay flow, are discussed. (BCA) Abstr. No. 408

41

Oldroyd, J.G.

Two-Dimensional Plastic Flow of a Bingham Solid: A Plastic Boundary-Layer Theory for Slow Motion

Proc. Camb. Phil. Soc. 43, 383

This paper is concerned essentially with the flow properties of a plastic solid of the Bingham type when stressed above the yield point. The equations of motion and the derived equation for the

stream function are much more difficult to solve than the corresponding equations for a viscous fluid. The approximate plastic boundary-layer equations are much easier to handle but are less widely applicable; they can be expected to give a reliable approximation only in regions of relatively rapid shearing. Only the simplest cases are discussed, where it happens that the whole region of flow is one of sufficiently rapid shear to be regarded as a boundary-layer. (BCA) Abstr. No. 735

1948 Documents

42

Cairolì, A.

The Extrusion of Ceramic Bodies Under Vacuum

Ind. Ceram. Silic. 1(5/6), 3

The advantages of extruding bodies of low plasticity under vacuum are enumerated, and the author considers that the resulting increase in plasticity merits further investigation in the light of current theories of plasticity, and to enable correct technology to be determined. (BCA) Abstr. No. 3422

43

Coulhon, A.

The Manufacture of Heavy Clay Products

Ind. Ceram. (387), 133

In this part of the review the main features of ball mills are discussed. 1fig (BCA) Abstr. No. 237

44

Johnson, A.L., and G.B. Hughes

Effect of the Sulfate Ion on the Plasticity of Brick Clays

J. Am. Ceram. Soc. 31, 194

Two red-firing Iowa brick clays were analysed for sulphate [SO_4] content by a method suitable for plant-control tests. From this datum the amount of barium carbonate required to react with this ion can be calculated. Plasticity measurements on (1) samples treated with the amount of barium carbonate indicated by SO_4 analysis, (2) untreated samples, and (3) samples treated with normal plant additions show significant differences in this property. These differences can be explained using the modern concepts of the factors which influence the zeta potential. 8fig (BCA) Abstr. No. 167

45

Macey, H.H.

Experiments on Plasticity. IV. The Phenomenon of "Backlash"

Trans. Br. Ceram. Soc. 47, 259

Certain clays, under continuously repeated alternating stresses, develop a looseness of structure, or an ability to undergo large deformation at small stress. The term "backlash" is proposed by analogy for this phenomenon which only appears in those clays or bodies in which the proportion of small particles is low. The phenomenon, and experiments illustrating its effect on stress-strain diagrams under different conditions, are described, and the relation between backlash and thixotropy are discussed. Both are considered to be due to the formation of layers in the clay between which most of the shear takes place, but to lie at extreme ends of a scale in the sense that backlash occurs with clays having few small particles, i.e., in which the perfection of packing of the particles is poor, while thixotropy occurs in those clays in which the packing is good. 4fig (BCA) Abstr. No. 164

46

Macey, H.H.

Experiments on Plasticity. V. The Behaviour of Clays in the Tensional Experiment with Particular Reference to the "Local Elongation" or "Necking"

Trans. Br. Ceram. Soc. 47, 291

Tensional experiments on clay bars at constant rates of extension are considered both as a whole and with particular reference to the second stage in which the clay pulls out into a "neck". Data on ten widely different clays are reported and discussed. A parallel with the behaviour of cold-worked copper bars under tension is found and part, at least, of the disagreement found between repeat experiments can be explained by the supposition that the clay bars have, originally, different arrangements of the particles or "structures", although made under identical conditions. In bars of the same moisture content, high maximum stress values are associated with low elongations. 17fig 5tab (BCA) Abstr. No. 165

47

Norton, F.H.

1948 Documents

Fundamental Study of Clay. VIII. A New Theory for the Plasticity of Clay-Water Masses

J. Am. Ceram. Soc. 31, 236

In spite of the large amount of work which has been done in the field of plasticity, none of the explanations is entirely fitted to the facts when dealing with clay-water systems of pasty consistency. As there is now a considerable amount of data on carefully fractionated and cleaned kaolinite, it has been possible to substantiate a

new mechanism of plasticity which is termed the "stretched-membrane theory". This theory accounts for the plasticity of the clay masses by the compression of the whole, due to the surface envelope of water, which tends to push the particles together by capillary forces. This theory is shown to be reasonable by both direct and indirect proof; however, it in no way changes the general picture of the forces acting between the particles in a suspension as portrayed by the colloid chemists. 6fig (BCA) Abstr. No. 166

1949 Documents

48

Coulhon, A.

The Manufacture of Clayware. VIII.

Ind. Ceram. (397), 106

A description is given of the different types of extrusion machines in which the propulsion is effected by rolls or by pistons, and of the die-plates and baffles, etc., in general use for extruded products. 6fig (BCA) Abstr. No. 299

49

Coulhon, A.

The Production of Fired Claywares. IX.

Ind. Ceram. (398), 135

In this section the author deals with the problems of lamination and gas occlusion, and describes types of de-airing screw presses. 3fig (BCA) Abstr. No. 578

50

Coulhon, A.

The Production of Fired Clayware. X.

Ind. Ceram. (399), 159

A description is given of the composite de-airing pug. It consists of a vertical screw-type vacuum press and an ordinary horizontal screw-type press. The pump and accessories required for de-airing are also described. The advantages of the de-airing of mixes also described. 2fig (BCA) Abstr. No. 1519

51

Gilard, M.

The Rapid Drying of Large Fireclay Shapes

Bull. Soc. Fr. Ceram. (4), 26

The application of humidity methods to the drying of large fireclay shapes up to 13 feet in length and 1.5 tons in weight, e.g., tank blocks, is described. With careful temperature and humidity control, and provided that the surface of the piece is kept at 3 degrees C above the dew-point of the air, the normal drying time of about 3 months can be safely reduced to 8-15 days. The

pieces thus dried, however, give a dull sound instead of the normal clear ring, are more porous, show 1% less shrinkage and have a coarser and somewhat laminated texture. 4fig (BCA) Abstr. No. 1184

52

Haefeli, R., and G. Amberg

Investigations on the Lamination and Shrinkage of Brick Clays

Mitt. Versuchsanst. Wasserbau u. Erdbau, Zurich, No. 17; Schweiz. Ton.-Industr. Nos. 1-6

After the mechanical characteristics of the raw clays had been determined with laboratory apparatus, experiments were carried out with model piston and worm extruders with different spacers and baffles of various shapes, the process of flow being traced by indicators of stained clay. The flow structures obtained were classified in 4 degrees of anisotropy, the specific electrical resistance serving as a good method of indication for the 1st and 2nd degrees and the formation of ice lenses on freezing for the 3rd and 4th degrees. The mechanism of shrinkage was subjected to a detailed theoretical study, the shrinkage pressure being calculated in terms of the external force required to produce an equivalent compression; attention was also paid to the proportion of flow and slip processes occurring during shaping and to the actual formation of the ice lenses. 31fig 2tab (BCA) Abstr. No. 873

53

Hummitzsch, W., and A.G. Bohler

The Measurement of Plasticity on Ceramic Bodies for Pressing

Radex-Rdsch. (1), 14

Ceramic mixes are used for coating welding electrodes. The coating is applied either by dipping or, more recently, by pressing. For the pressing process plastic properties are required. In this connection the possibility of measuring the plasticity by means of the Brabender Plastograph is of particular importance. This permits a thorough study of the pressing properties of ceramic mixes. 12fig (BCA) Abstr. No. 2017

1949 Documents

54

International Furnace Equipment Co., Ltd., and
L. Bailly

Improvements Relating to the Manufacture of Bricks or Blocks from Plastic Material

Patent No. Brit. GB 624,271, 1 Jun, 1949,

In this combined apparatus the material first passes through an extrusion machine and is then cut into bricks or blocks of the required size; endless conveyors transfer the shaped ware to a point at which it is loaded by means of grippers on to trucks; a number of these trucks are mounted on a turntable which revolves and places the filled truck in position for delivery along a track to the dryer, and at the same time brings the next truck into position for loading. The whole sequence is automatic and continuous. 7fig (BCA) Abstr. No. 301

55

Jones, J.S.

An Approach to the Problems of Extrusion

Claycraft 22, 509

It is questioned whether faults occurring subsequent to extrusion are those of further processing, or if they were introduced during extrusion. Design of an extrusion machine is difficult because insufficient is yet known of the physical properties of clay. The variation in plasticity is thought to be the basic cause of extrusion troubles; variation of moisture content is also an important factor. Some investigations were carried out which commenced at the fired product stage; these were described but are inconclusive. It is shown that moisture distribution is not even throughout the body, and it is contended that so long as the water content influences the sliding properties of the clay/water mass, and the water content is evenly distributed, extrusion troubles are unavoidable. In the clay tempering, care must be taken that the time factor will allow for sufficient wetting of the water-repellent clays. Surface tension of "awkward" clays must be overcome by the use of hot tempering water or

the addition of a wetting agent, e.g., soda ash. (BCA) Abstr. No. 300

56

Mosthaf, E.

Let Clay Make its Own Die

Brick Clay Rec. 115(3), 45

The advantages are outlined of the use of a soft wooden die which allows the extruding clay to wear it into proper shape, after which it is used as a pattern for the casting of the regular metal die; kiln-dried white pine or hard balsa wood are suggested as being suitable. The use of tungsten carbide sizing plates is recommended to increase the life of dies. 3fig (BCA) Abstr. No. 302

57

Mosthaf, E.

Long Extrusion Dies Cut Losses

Ceram. Ind. (Sevres, France) 53(2), 70

Dies are compared with the straight-ram type pressure method of extrusion. Well designed dies and pins can reduce cracking and increase fired strength as a result of ensuring uniform green density, which may be obtained by making the die sufficiently long to create side-wall friction to a certain degree. A drilled honeycomb plate is considered superior to the use of three or four winged pin supports; this allows for better reheating and obviates a striation line on the surface. For circular shapes the dies and pins should be easily interchangeable; for square and rectangular shapes the die should be longer. WC dies and pins are recommended if close tolerances are required or if the body is highly abrasive. 5fig (BCA) Abstr. No. 872

58

Weinberg, V.

Improvements in the Manufacture of Bricks, Tiles, Pottery, Stoneware and Other Products of the Ceramic Industries

Patent No. Brit. GB 627,477, 10 Aug, 1949,

The addition of a surface-active agent to a clay reduces the amount of water needed to give max-

1949 Documents

imum workability; cohesion is also stated to be improved. Additional benefit is obtained by the admixture of a lubricant with the clay. The amount of surface-active agent and or lubricant

added may vary from 0.5 to 5% of the water used, and a suitable agent for the purpose is sludge from an oil refinery. (BCA) Abstr. No. 874

1950 Documents

59

Organic Binders

Ceramics (London) 2, 4

The results are given of investigations on the action of binders in improving working characteristics of non-plastic materials. The extrusion properties of mixtures of talc and water and the pressing properties of flint and water were studied. The use of binders always increased the dry strength and also appeared to increase the air-drying time. Drying shrinkage was greater. From these two experiments it was concluded that, apart from any economic factor, the best possibilities existed with the gums, alginates, alcohols and celluloses. A table shows the effect of binder additions on the physical properties of fireclays; gums and alginates; alcohols and cellulose derivatives; proteins; wood extracts; compounds of silicic acid; and miscellaneous (e.g., resin, rubber, etc.). Short notes on each class are given. 3tab (BCA) Abstr. No. 2537

60

Beckemeyer, H.J.

Fundamentals of the Drying Process. I and II.

Brick Clay Rec. 117(4), 47; (5), 50

Mechanisms of drying are discussed, and various theories of the physical behaviour of the clay-water system during drying are reviewed briefly--3-stage, 2-stage and the capillarity theory. Experimental work indicates the possibility of several mechanisms controlling internal moisture flow, the main ones being diffusion, capillarity and pressure gradients due to shrinkage. The 2-stage theory is considered the most logical and is discussed. These considerations do not apply to infra-red or dielectric methods of drying. Tunnel dryers for bricks generally operate on the counter-current principle. The warm but moist air first encountered by the ware gives little water removal but has a heating-up effect; progressively the ware meets warmer and dryer air so that evaporation takes place at the surface. This is advantageous because it tends to prevent premature "case-hardening," decreases the vis-

cosity of the water, and subsequent diffusion occurs more rapidly. Recirculation of air can enable temperature and humidity to be more rigidly controlled and, in some cases, makes a shorter dryer possible. The presence of soluble salts is an influencing factor because of the effects upon moisture movement and upon the clay itself through the presence of the adsorbed ions. Shrinkage must be considered, whether diffusion, capillarity or pressure is involved. Ability to withstand the stresses is dependent largely upon the type and amount of clay mineral present, the amount of non-plastic materials and upon the amount of both solution and adsorbed ions. It has been concluded that maximum stresses occurring at the surface coincide with the period at which the surface shrinkage limit is reached; it is possible that the drying time can be shortened and troubles due to condensation can be avoided. It has also been suggested that instead of ware being introduced into a warm and humid atmosphere, the air should be of a high temperature but of low humidity initially; when the critical period is reached, the role of drying should be slowed by increasing the humidity, after which the rate of drying can be increased. 4fig (BCA) Abstr. No. 1667

61

Inzigneri, M.

Making Raw Materials and Ceramic Bodies Plastic

Ind. Ceram. Silic. 3(8), 9

The many theories of plasticity are a proof of the complexity of the problem. The main concepts of plasticity are given. The lamellar structure, particle size, presence of air and Norton's stretched-membrane theory are discussed in their relation to plasticity. The capacity of the clay minerals to interchange their surface cations with cations in the surrounding medium is discussed. The hydration of the surface cations and the attraction between the clay particles, and of the non-plastic quartz and feldspar, to the positive cations bound to the clay minerals are explained. The most favourable conditions of attraction between the particles, and therefore of plasticity, are

1950 Documents

explained on the basis of the theory of condensers (the Helmholtz double-layer theory). The potential creating the best conditions of plasticity should be low. In the series H, Al, Be, Sr, Ca, Mg, NH_4 , K, Na, Li, the dielectric constant decreases and the thickness of the double layer increases. At the border of the lyosphere, in the presence of the last elements, there will be strong forces of repulsion favouring deflocculation. Schlosing showed that colloidal clay is present only to a very limited extent. It was also shown that hydration is not simple physical mixing but that a chemical reaction occurs. The clay can be considered as electrolyte or acid, formed by macro-anionic clay- OH^- bound to H^+ , which can be substituted by Ca^{2+} , Mg^{2+} , Na^+ , K^+ , NH_4^+ , etc. The quantitative determination of the exchange capacity is described; it is proportional to plasticity. The conclusion is drawn that in the natural state the most plastic clays are those bound to the alkaline-earth metal cations, and containing a certain amount of minerals with high exchange capacity. Pfefferkorn's method was used to measure plasticity. To the clays were added CaO , $\text{Ca}(\text{OH})_2$, $\text{Al}_2(\text{SO}_4)_3$ (calc. as Al_2O_3), CaSO_4 , CaCl_2 , and BaCl_2 . All except the CaO were added to the clay slip in solution or suspension; the CaO was added dry. Then they were mixed mechanically and poured on to plaster batts. The results were very good and the most striking with CaO . Small amounts of $\text{Al}_2(\text{SO}_4)_3$ mixed with $\text{Ca}(\text{OH})_2$ also gave very good results. To clay with a Pfefferkorn number of 24, the addition of 2% CaO increased the plasticity number to 32; but above a value of 26, flocculation becomes increasingly marked with swelling and irregular formation of lumps. The transformation therefore of a poorly plastic clay into a highly plastic one is very difficult on an industrial scale because of the great amount of H_2O that would have to be added to avoid the above trouble. This applied also to all the clays tested. Increasing the plasticity only slightly, i.e., by adding in this case (%): 0.5 CaO , 0.7 $\text{Ca}(\text{OH})_2$, 3.24 $\text{Al}_2(\text{SO}_4)_3$, or 0.5 $\text{Ca}(\text{OH})_2$ + 0.1 $\text{Al}_2(\text{SO}_4)_3$ gave trouble. In the next case CaSO_4 , CaCl_2 were compared with CaO in increasing the plasticity of a kaolin; their effect was negligible. This same

kaolin was further ground finely, increasing the Pfefferkorn No. from 30.8 to 32.9 and by addition of 1% CaO or $\text{Ca}(\text{OH})_2$ or 1% Al_2O_3 (6.40 $\text{Al}_2(\text{SO}_4)_3$ to 35. Ware formed from clay with plasticity increased to the practical limit of 26 became much more workable, and the rejects after drying and firing decreased. The breaking strength of the dried product was also determined; in general there was an increase in strength, but this was not always proportional to the increased plasticity. 4fig 12tab (BCA) Abstr. No. 603

62

Moore, C.E.

Plasticity

Claycraft 23, 579

Thin films of water attached to the surfaces of the clay particles may account for observed plastic behaviour. Notes are given on the influence of grain size and the importance of the development of acidity in ageing or souring by inducing flocculation. De-airing probably improves wettability by removal of the air which hinders wetting; uniform water distribution is of major importance. (BCA) Abstr. No. 602

63

Scholl, F.

Drying in the Brick and Tile Industry

Ziegelindustrie 3, 355

From the physical point of view a "dry" brick is a mixture of air, water and clay. Between the molecules of these substances arise surface forces, the nature and magnitude of which depend on the properties of the substances. The forces between water and clay are the most important; those between water and air, and clay and air, can be ignored. Evaporation of water from the brick surface sets up a moisture gradient. Owing to capillary forces, water is sucked from the wetter zones to the drier zones. Assuming that the capillary forces are acting against friction alone (while gravity is ignored) the following formula can be used (according to O. Krischer): $dG_x = F.k.f.(df \text{ over } dx).dt$ where d

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G_x (g) is the amount of water travelling during the time element dt through a cross-section F (cm^2); $(df \text{ over } dx)$ (g/cm^4) is the moisture differential in the given cross-section and k_f (cm^2/k) is the so-called moisture-conductivity number. This itself depends again on the amount of moisture, the temperature and the capillary distribution curve. The moisture content and the capillary size determine the degree of the capillary suction. The speed with which the water travels from the core to the surface influences the drying rate and can be expressed (according to the above equation as: $(d G_x \text{ over } dt.F) = k_f.(df \text{ over } dx)$). 2fig (BCA) Abstr. No. 709

64

Sigg, J.

The Preparation of Clay for Heavy Clay Ware and the Soft Mud Process

Ind. Ceram. (414), 301

In a general article the importance of adequate mixing and ageing is emphasized; control is necessary in the latter process because excessive ageing tends to cause lamination. It is noted that a slight increase in the water content of the mix reduces considerably the power required for pressing and, in the soft mud process, also helps to eliminate lamination. Care should be taken to adjust the feeding and die pressure of augers correctly when changing from the production of hollow to solid bricks or vice versa. (BCA) Abstr. No. 1482

65

Sulzer Bros., Ltd., S.J. Moore, and Ltd. Josiah Wedgwood and Sons

Improvements in or Relating to Apparatus for Feeding Clay or Like Plastic Material to Mechanism in Which It Is to Be Moulded into Pottery or Line Articles

Patent No. Brit. GB 640,132, 12 Jul, 1950,

A de-airing pug for the preparation of pottery bodies is described. The improvement relates to the feeding mechanism. 2fig (BCA) Abstr. No. 435

66

Zoellner, H.

The Transverse Strength of Raw Clay as a Plant Method for the Determination of the Plasticity of Clays, Kaolins and Ceramic Mixes

Sprechsaal 83, 271

The transverse strength is determined on an air-dried plastic cylinder of the clay. Plasticity depends on the grain size and mineral composition. Steger proposes as a measure for plasticity the amount of particles greater than 2μ diam; this is only a partial characteristic, although a very important one. The base-exchange capacity also offers an indication of the grain size and mineral composition. The content of plastic substance can further be determined by the loss on ignition. The mineral content can best be found by the DTA method, which gives separate data on the montmorillonite and kaolinite groups. X-ray analysis of the structure and dilatometric measurements can also be used. An apparatus for the determination of the unfired transverse strength (first proposed by H. Kohl and now improved by the author) is described in detail. A list of average values found for 43 German clays and kaolins is given. 4fig 1tab (BCA) Abstr. No. 642

1951 Documents

67

Proper Die Lubricant Makes Extruding Easier

Brick Clay Rec. 119(6) 59

Some of the water-soluble by-products of oil refineries will form emulsions with ordinary brick oil; such an emulsion will be held better by the surface of the clay column, with consequent benefits to the extrusion process. In some cases 10% of the emulsion is sufficient to effect a marked improvement. No details are given of the materials used. (BCA) Abstr. No. 1147

68

Davenport, S.T.E.

A Freezing Technique for Works Extrusion Problems

Trans. Br. Ceram. Soc. 50, 101

A study has been made of the problem of the waste associated with the manufacture of floor quarries by a process that includes the repressing of clots cut from ribbons after extrusion through multiple dies. The faults obtained indicated the structure of the extruded column as a primary source of trouble. Freezing of clots and sections of the column in the green state illustrated the structure of the column at all stages of its formation. Subsequent tests established the overwhelming importance of die design in controlling the structure of the column. A study of freezing patterns and relevant cracking figures led to a design of die that reduced waste, thus confirming the theory that the freezing pattern is largely indicative of the power of the extruded article to withstand subsequent stresses, especially those set up during drying. There was also an interesting relationship between the freezing pattern and the transverse shrinkage of the extruded column, which, in addition to differing from the longitudinal shrinkage, varies in different positions in the column. A note on the effect of pressure variation across the face of the column is included. It was found that the modifications to the die necessary to produce appreciable pressure variations and consequent differences in ribbon widths and thicknesses and

ribbon speeds of extrusion are surprisingly small. It is suggested that the interpretation of the freezing pattern might be useful in works investigations to indicate the effect of modifications to the extrusion machinery. 10fig (BCA) Abstr. No. 1968

69

Hisschemoller, F.W.

The Origin and Prevention of "Blind" Cracks in Paving Bricks

Klei 1(1), 8

Barely visible, or "blind," cracks, which often occur in dry bricks, are sometimes difficult to detect. Methods of identification of cracked bricks are discussed. "Completely dry" bricks still contain 3-5% hygroscopic water, which subsequently escapes when heated to 100 degrees C, causing further shrinkage. If drying proceeds too fast, the tensile stresses arising from the shrinkage tear apart the dry particles. This is because, during drying, the material gradually loses its plasticity and becomes less capable of stretching under the shrinkage stresses. It is suggested that the dark colour of cracks is due to oxidation. (BCA) Abstr. No. 1781

70

Krahn, W.H.

Drying in the Brick and Tile Industry

Ziegelindustrie 4, 12

In a brief discussion it is pointed out that many of the faults occurring during drying are due to faulty shaping. Some experiments are described to confirm this suggestion. (BCA) Abstr. No. 1782

71

Macey, H.H.

Research Problems in the Heavy Clay Industries

Claycraft 24, 516

The demand from the heavy clay industry is for technical development to reduce labour requirements, for the prevention of wear of machine

1951 Documents

parts and for fuel economy. There is also a need for a good test for frost resistance. Screening, especially through inclined perforated plates, might be studied mathematically. The merits of extruding clay hot and the electrical lubrication of dies should be examined more closely. The general features of research are also briefly discussed. (BCA) Abstr. No. 2417

72

Singer, M.J.

Considerations on De-Airing Clay and the Pugs Used for this Purpose

Klei 1(12), 37

Requirements for vacuum pugs and a survey of the commoner types, their merits and demerits. 6fig (BCA) Abstr. No. 2111

1952 Documents

73

Ficai, C.

On the Theories of the Plasticity and Workability of Clay Products and the Principal Methods for their Determination. I.

Ceramica 7(10), 41

The definition of plasticity and workability, P. S. Roller's theory of plastic flow, the colloidal theory of plasticity, F. H. Norton's theory of membrane tension, factors determining plasticity, the size of particles and their surface development, the shape and state of aggregation of particles, the colloidal fractions present, the proportion and state of water present in the system, base-exchange and colloidal phenomena, are discussed. (BCA) Abstr. No. 1641

74

Ficai, C.

On the Theories of the Plasticity and Workability of Clay Products and the Principal Methods for Their Determination. II.

Ceramica 7(11/12), 79

A complete explanation of plasticity is still lacking. The discrepancies between F.H. Norton's colloidal and membrane-tension theories may be reconciled by the one theory becoming complementary to the other. The two parameters (the elastic limit and maximum extension without breakage) characterizing the plasticity do not give an absolute definition and differ considerably in their interpretation of the character of a clay-water system in the plastic state. No single method or apparatus can give the measurement of plasticity in a single value. The plastic behaviour of clay should therefore always be evaluated on the basis of the sum of a number of measurements. For measuring plasticity, the Nadai compression apparatus adopted by Russell and Hanks, and Dettaille's apparatus for testing torsion, seem to give the best results. (BCA) Abstr. No. 2103

75

Henze, W.

The Dry Strength of Kaolins, Clays and Ceramic Bodies

Silikattechnik 3, 496

A survey of work by Bartsch, Kohl, K. Krah, Salmang, Endell, Wartenberg, Kieffer, Lehmann, Jacoby, Simpson, Clews, Pfefferkorn, and others. 2tab (BCA) Abstr. No. 1640

76

Loichot, P.F.

Die Design and Operation in Clayworking Plants

Am. Ceram. Soc. Bull. 31, 73

The Neidergesaess (sheet-steel-liner brick die) is described. Lubrication pressure for brick dies is less than or equal 35 lb/in.², but for hollow-ware dies the lubrication pressure may be as high as 100 lb/in.². Bridges should be set well back from the die, and V-grooved in the wall-forming areas to roughen up the surfaces of the clay after it has passed the bridges. Examples are given of troubles with the flow of tile columns in pugs. A disadvantage of the auger is the uneven pressure exerted on the clay; this does not occur in steam extrusion-presses. 3fig (BCA) Abstr. No. 2114

77

Maack, P.

Internal Deformation as a Characteristic of Clay

Ziegelindustrie 5, 115

The author writes at length of the inadequacy of the existing methods for the determination of plasticity and describes a new method based on the measurement of the deformation work within a mix subjected to torsion. The method involves a "torsion plastograph" and auxiliary approaches for the ageing of clay and for a rapid determination of the percentage of mixing water. 1fig (BCA) Abstr. No. 2771

78

Voskuil, J.

1952 Documents

**Plastic Deformation of Some Dutch Clays
at Higher Temperatures**

Trans. 3rd Int. Ceram. Congr., 1952, p. 47

The effect of warming a clay on its workability depends on the clay material present, the proportions of fine fraction ($-2\ \mu$) sand, silt, grog, tempering-water, and air present. The last factor has not yet been investigated. 6fig 1tab (BCA)
Abstr. No. 1201

1953 Documents

79

Carley, J.F., R.S. Mallouk, and J.M. McKelvey
Simplified Flow Theory for Screw Extruders

Ind. Eng. Chem. 45, 974

The flow behaviour of a viscous liquid (plastics) in the channel of an extruder screw is shown to be similar to the flow behaviour of viscous liquids between infinite parallel plates, one of which is stationary and the other moving. Assuming Newtonian behaviour of the liquid, a differential equation was derived that relates the rates of extrusion and the die pressure to the screw and die geometry and to the operating variables. Integrated flow-equations are given for the special case in which the viscosity of the liquid is constant throughout the screw channel (isothermal extrusion). Equations are also given for the case in which the dimensions of the screw channel are functions of their position along the screw. 5fig (BCA) Abstr. No. 2183

80

Carley, J.F., and J.M. McKelvey
Extruder Scale-Up Theory and Experiments

Ind. Eng. Chem. 45, 989

The design of extruders receiving solid particles or strip feeds is of economic interest to the plastics industry. However, no experimentally valid theory of behaviour for the solid in the rear of an extruder has as yet been achieved. Using the theory of melt extruders as a guide, together with experimental evidence on the behaviour of solids and of "plasticizing" extruders, we have obtained rules for predicting the performance of large extruders from the performance of geometrically similar models. If similar extruders are run adiabatically at equal speeds and one is x times as large as the other, their outputs and power consumptions will be expected to be in the ratio $x^3:1$, while their output pressures and temperatures will be equal. These rules imply that in many cases the heat of melting can be supplied by the mechanical action of the screw rather than by transfer through the barrel walls. Designs based

on this principle should lead to smaller, more economical extruders. 1tab (BCA) Abstr. No. 2187

81

Carley, J.F., and R.A. Strub

Application of Theory to Design of Screw Extruders

Ind. Eng. Chem. 45, 978

The pumping efficiency of a melt extruder (for plastics) is the delivered power, $Q \Delta P$, divided by the total power consumed by the screw. By manipulation of the flow and power equations it is shown that the efficiency of a melt extruder is a function only of the screw and die dimensions and is independent of the screw speed, the throughput, the rise in pressure of the melt and the viscosity of the melt. Formulae are derived for the design of efficient extruders to pump melts, the temperature of which must be closely controlled during extrusion. The effects of nine design factors on the principal screw dimensions are investigated numerically for a typical example. In extrusion jobs where the melt could absorb only very little of the mechanical heat, large factors of safety have been used to ensure the thermal protection of the melt. The present method offers the hope of substantial savings in both investment and power costs by making it possible to find the smallest extruder of near-optimum efficiency that will safely do the job. 9fig (BCA) Abstr. No. 2184

82

Carley, J.F., and R.A. Strub

Basic Concepts of Extrusion

Ind. Eng. Chem. 45, 970

Refers primarily to the extrusion of viscous liquids and plastics. 5fig (BCA) Abstr. No. 2182

83

Detaille, H.

A Contribution to the Study of Plasticity

Bull. Soc. Fr. Ceram. (21), 2

1953 Documents

The deformation of elasto-plastic material under a given stress is studied as a function of the water content. Research undertaken at the Institut National des Silicates and based on torsional deformation proved that deformation does not follow Bingham's law for all water contents. The colloidal and rheological properties of clay, the interpretation of torsional deformation curves obtained with normal, thixotropic and rheopectic bodies, and the determination of the water content giving maximum working plasticity, are discussed. Particular emphasis is laid on the existence of a critical water content. 17fig (BCA) Abstr. No. 1527

84

Mallouk, R.S., and J.M. McKelvey

Power Requirements of Melt Extruders

Ind. Eng. Chem. 45, 987

Refers to extrusion of plastics. 1fig (BCA) Abstr. No. 2186

85

McKelvey, J.M.

Experimental Studies of Melt Extrusion

Ind. Eng. Chem. 45, 982

Refers to extrusion of plastics. 6fig 8tab (BCA) Abstr. No. 2185

86

Purchase, N.W., and S.J. Tupper

Experiments with a Laboratory Extrusion Apparatus Under Conditions of Plane Strain

J. Mech. Phys. Solids 1, 277

Experiments on the small-scale extrusion of lead are described. The results are compared with the theory of extrusion due to Hill (J. Iron St. Inst., 158, 177, 1948). Excellent agreement is found between the measured pressures of extrusion and those predicted by the theory; the flow patterns also are in general agreement. In minor details, such as the extent and shape of the "dead" metal region, and the behaviour of material along the longitudinal plane of symmetry, there are some divergences. 6fig 1tab (BCA) Abstr. No. 1528

87

Schenk, F.

The Cause and Elimination of Drying-Cracks on Hollow Clay Ceiling-Blocks

Ziegelindustrie 5, 913

Experiment has shown that the rate of drying has a considerable influence on the formation of S-shaped and other cracks. The success of drying depends very much on the uniformity of temperature and the relative humidity in the dryer. (BCA) Abstr. No. 1717

88

Spingler, K.

Manufacture of Perforated Bricks and the Power Factor

Ziegelindustrie 6, 90

Possible methods of improving the power factor of electric motors are explained for the benefit of small brick and tile plants that are attempting the switch from solid to perforated bricks. If, instead of a normal pug, a vacuum-pug is installed, an adequate power factor can be cheaply achieved, without overloading the transformer, by the use of suitable condensers. (BCA) Abstr. No. 2180

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89

Baker, D.M.

Extrusion as a Method of Forming

Ceram. Age 64(5), 41

The importance of clay uniformity and structure, and the power and size of the extrusion machine are stressed. The length of the auger used has to be 3-4 times its diameter, and the auger has to develop from 90-100 lb/in.² at the nozzle without "flashback" in the vacuum chamber. With an experimental arrangement, good solid stock about 120 times the auger area has been made; normally only 4-5 times the auger areas are required. Pieces formerly jiggered are now extruded at 1/5 to 1/4 of the cost. (BCA) Abstr. No. 1205

90

Christopher, A.B.

Recent Advances in Extrusion Machines and Methods

Brick Clay Rec. 125(5), 48

In recent years the pugging of the raw material has received much more attention than formerly. Experiments are being made to determine the advantages of heating clay in the pug-mill. Blowing air at 530 degrees C into a covered mill led to a saving of 25% of the power required for the mill and extruder. The extruded bricks had an internal temperature of 57 degrees C; they began to dry at once, thereby increasing dryer capacity and reducing dryer and kiln loss. General quality of the product was improved. Dry clay and superheated steam gave the best results. The process would be valuable for hollow ware. Some plants use two pug-mills for more uniform preparation and to give the water longer to penetrate the grains. With some shales, pugging under vacuum has resulted in much better products. Combination de-airing machines can have a clutch on the pug section so that only one motor and gear box are required. The pug-mill output can be matched to the pug requirement. Large refractory blocks or pyrometer sheaths can be made on the same machine. The gear reduction is between 10:1 and 12:1, the cost being offset largely by sav-

ings in the motor, belts and sheaves. A typical drive is a 150-hp motor mounted on the machine. Air clutches with remote control are desirable in machines that must start and stop several times per minute. Normal extrusion pressures are up to 400 lb/in.², special units go up to 2,000 lb/in.². (BCA) Abstr. No. 1202; 1206

91

Diettrich, H.

Preparation Machines

Keram. Z. 6, 377

It is stated that preparation would be greatly improved if between the preparation machinery and the pug there were a mixer of large capacity in which the material would remain for a long time. Neither box feeders nor normal mixers quite meet the requirements; a so-called round feeder is recommended in which the material remains for about 20 minutes, while it is constantly stirred by a 3-arm stirrer. For a complete homogenization of the material a souring-tower is advised. Since in an ageing-pit the greatest homogenizing is during the first 12-24 hours, building an expensive aging-pit is uneconomic if a cheaper ageing-tower with a capacity of 100 tons can be acquired. The great pressure due to the weight of the material and small evaporation surface combine to give the material a very thorough preparation. The operating cost is negligible. 3fig (BCA) Abstr. No. 616

92

Franz, K., and W. Stauch

New Developments and Improvements in the Design of Heavy-Clay Machinery

Silikattechnik 5, 543

Machinery at the Leipzig Fair is briefly described. In a clay-shredding machine for hot preparation, steam is supplied through pockets cast in the bottom of the machine. In an improved vacuum pug the vacuum chamber is much bigger and has large rolls coupled directly to the shaft of the feed-rolls. This does away with the chain drive which has many wearing parts. A combined vacuum-pug for large hollow blocks

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consists of two horizontal worms: the upper serving for further preparation with steam and feeds the de-airing pug. The de-airing chamber is between the upper and the lower shafts. The de-airing can be watched through two large sight-holes. 1fig (BCA) Abstr. No. 1203

93

Hawk, E.A.

Handling the Difficult Extrusion Problem

Am. Ceram. Soc. Bull. 33, 326

Conditions influencing the design of extrusion machines for widely varying types of materials are discussed. A method for computing barrel and auger areas is included. (BCA) Abstr. No. 1208

94

Heil, A.C.

Dry Pressing or Extrusion?

Ziegelindustrie 7, 724

It is argued, in a short note, that dry-pressing is less suitable for building-bricks than extrusion, except when the raw clay has very little plasticity. (BCA) Abstr. No. 619

95

Herwegh, C., and T. Schumann

Detection of Lamination in Freshly Extruded and in Fired Bodies

Ziegelindustrie 7, 1006

A piece (a few cm thick) of the clay column is cut by wire and placed on a porcelain plate in a desiccator containing water so that the specimen is just submerged. The desiccator is evacuated; a water pump (about 20 mm Hg) is generally sufficient. After evacuation for 1-6 minutes the vacuum is released, and the specimen is taken out and rinsed. Any laminations will be immediately visible. With fired bodies laminations are more difficult to detect. Salmang recommends saturation with KMnO_4 ; MnO_2 will separate out and reveal any lamination. In the authors' laboratory the fired body is boiled in paraffin containing oil-soluble aniline dyes. The specimen

is polished, and any lamination will appear clearly. Very fine lamination lines can be polished, etched slightly with HF, and inspected under the microscope. 7fig (BCA) Abstr. No. 1211

96

Hnoysky, F.

Making Mouth-Pieces in Brickworks

Oest. Ziegl. Ztg. 4, 278

A long but general discussion, with elementary theoretical explanations, on extrusion, with little reference to the title of the paper. 6fig (BCA) Abstr. No. 1207

97

Kreger, J.M.

Extruding Clay: The Problem of "Slicking"

Brick Clay Rec. 125(6), 67

"Slicking," which is produced on the surface of the clay by pressure against the smooth metal face of the point or discharge auger, can be eliminated by a "Spider" secured to the point end of the discharge auger. The "Spider" comprises 4 knives on 90 degree centres welded to a round plate fastened to the auger by an internal bolt. The outside diameter of the knife arrangement is 6 3/4 in. Rotating with the point auger, the "Spider" breaks up the slicking surface and distributes it throughout the mass. (BCA) Abstr. No. 1209

98

Lehmann, H., and G. Marx

Influence on Fluidity of Clay Slips of Additions of Soda and Quebracho Extract and the Effect of Quebracho Extract Additions on the Dry Green Strength of Moulded Clay Bodies

Tonind. Ztg. 78, 323

Small proportions of quebracho extract and soda were added to a plastic clay and to a lean clay to ascertain whether the moulding properties would be improved. Quebracho extract did not have the

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same deflocculating effect as soda, and cannot be used as a substitute for soda. The extract prevented the increase in viscosity that usually occurs when soda is added in excess, and the stability range of the slips was substantially widened; dry green strength increased with extract additions of 0.2 to 1.0%, by 5.0% for every 0.1% addition. 6fig 1tab (BCA) Abstr. No. 2090

99

Neilson, J.F.

De-Aeration and Kindred Subjects

Clay Prod. J. Aust. 21(7), 8

After referring to the early development of de-airing machines, the author briefly lists the main parts of a de-airer and their respective functions, also the advantages claimed for these machines. The working vacua recommended are 20-27 in. for sewer pipes and 26-28 in. for bricks; it is important that these vacua should be constant. The effect of water vapour created by high vacuum in the chamber is stressed, and tests are described together with others on the varying of clay mixtures, particle size, machine alterations, methods of preparation, and variation of vacuum. It was found that the best grading was 25% coarse, 50% medium, 25% fine, and that the use of cores helps to overcome differential pressures. (BCA) Abstr. No. 30

100

Schienner, N.

The Physics and Heat Technology of Hot Preparation and Hot Shaping

Ziegelindustrie 7, 717

First the author investigates the temperature reached by clay during hot preparation and what amount of heat should be used; he then emphasizes the importance of a uniform supply both of moisture and heat and discusses the most suitable points of supply. The advantages of hot preparation are shown in tables. 4fig 2tab (BCA) Abstr. No. 617

101

Smith, R.K., and A. Turner

Elements of Engineering Design, with Particular Reference to the Ceramic Industry

Refract. J. 30, 95

After discussing engineering design in a general way, the authors consider the design of dies for a pipe-extruder. They specify that: (1) The die must be returned to the closed position in the minimum possible time. (2) The die faces must not be damaged by excessive force or momentum. (3) The die must not drop backwards on closure. (4) The die must be closed with sufficient pressure to withstand the clay extrusion due to socket pressing. (5) The high pressure must be released without shock, instantaneously, and without the die dropping. (6) The table must retract or lower and provide an adjustable amount of back pressure so that resistance to barrel extrusion is sufficient to keep the socket die in contact with the pipe. (7) The table carrying the socket die must fall clear of the pipe for removal. The starting of the machine must be synchronized with die closure, and the stopping of extrusion must be synchronized with the position of the pipe when at the desired length. (8) The sequence must be automatic. (BCA) Abstr. No. 2118

102

Sulger, O.

Clay Preparation: Lamination, Cracks and Accuracy of Measurements

Oest. Ziegl. Ztg. 4, 276

Lamination is caused by the torsional movement of the clay column pushed forward by the auger. This fault can be reduced by designing the auger, or its tip, to protrude right into the spacer. Another method is to insert a ring 3-5 in. long, between the barrel and the spacer. This ring has three blades of fish-belly shape, inclined at 120 degrees, which move tangentially to the circle followed by the rotating auger shaft. It may be useful just to fill in "dead" corners in badly designed spacers. Attempts to eliminate lamination have also been made by installing a grid of

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steel bars between the barrel and the spacer. Clays sensitive to drying ought to be weathered for one year in dumps 10-ft high, which should be watered. (BCA) Abstr. No. 1210

103

Tarasenko, M.S.

The Causes of Lamination in Ceramic Products and Methods for its Prevention

Glass Ceram. (Engl. Transl.) 11(9), 4

The author believes that lamination is caused by the sudden change in the direction of flow of the clay at the junction of the mouth-piece and the spacer. Lamination may be prevented by the addition of compressible combustible material (saw-dust, peat, etc.) and by the use of longer spacers. The more common type of lamination, the formation of slip planes, is the result of tangential stresses and non-homogeneity of the raw materials. This lamination can be eliminated by de-airing. Slip planes in bricks may be avoided by adjusting the mix, preparing the mix with machines having "network" barrels (no further details given), and the use of pugs of small diameter. 12fig (BCA) Abstr. No. 618

104

Wunderlich, H.

Development of Machinery for the Fine Ceramic Industry in the German Democratic Republic

Silikattechnik 5, 540

A brief review of machinery developed by a Thuringian firm. Data on four vacuum pugs are tabulated; the upper worm blades can be easily replaced and are interchangeable with the blades of the lower shafts, which wear out sooner. Easy operation is ensured by an additional plate clutch on the rapidly rotating shaft. The machines are 22% lighter in weight than previous types. A small vertical laboratory pug has the upper and lower worms on one shaft, and the body is fed by the upper. The de-airing can be watched through a peep-hole. A semi-automatic grinder for saggars up to 15 in. diam and 7 in. high is operated by two men; the saggars are pressed on to the lap by the weight of pressing-arms which rise hydraulically at fixed time intervals. Eight saggars can be charged at a time. Grinding (200-400 saggars per hour) is by sand and water on a grey cast-iron lap. A glaze-sponging machine has two sponge-rubber belts running in the same direction but at different speeds. The belts run through a tank of water to clean off any glaze. 5fig (BCA) Abstr. No. 1204

1955 Documents

105

The Jam-Socket Pipe Machine

Br. Clayworker 64, 51

The Pacific Clay Products Co., Los Angeles, has increased output by using separate machines for pipe extrusion and socket forming. Production is 3,300 6-in. x 3 1/2 ft pipes and 3,600 4-in. x 4 ft pipes in 7 1/2 hours. Other equipment includes: an automatic cutter with roll-off apron; the Jam socket machine, which also finishes the spigot; a conveyer with automatic inside glazing unit; a stand-up unit with pallet positioner; grouping table for 6-in. pipes. The manufacture is outlined. 3fig (BCA) Abstr. No. 2846

106

Davenport, S.T.E.

Trials on a Roofing-Tile Works. I. A Vacuum Mixer

Trans. Br. Ceram. Soc. 54, 433

The Walker vacuum mixer, which embodies a de-airing extrusion unit, employs a new principle designed to give improved de-airing and tempering, at the same time economizing on more usual plant arrangements. Dry, ground clay is introduced into a vacuum chamber where controlled amounts of water were added. The de-aired plastic clay then passes into an extrusion worm. Works trials made with this machine showed a definite saving on labour, power consumption, and capital expenditure. Although the principle employed in this machine would seem to have much to commend it, the trials show that associated problems (feed arrangements, vacuum, extrusion design) must be solved before the machine can be included in a normal production line. (BCA) Abstr. No. 2843

107

Frenkel, M.S.

Enforced Order Mixer and New Adjustable Extruder

Chem. Age (London) 72, 1435

A new continuous mixer for chemical materials in powder or other form is described and shown

in application to a new extruder in which it is incorporated. The rotational speed is adjustable as a function of position along the extruder axis. This enables the required changes-of-state, mixing, density, temperature pressure, etc., to be produced according to the properties of the material and the required extrusion conditions (without altering the geometrical configuration of the apparatus) by adjusting independently of one another the angular velocities of certain components along the axis. The extruder is thus widely applicable for different materials and applications and can also be used for research to determine best adjustments for any material and performance. It combines compounding, etc., in one machine and provides adiabatic uniform controlled heat input. Detailed descriptions and diagrams of the new mixing apparatus, the extruder, and a multi-mixer and a dynamic gland involving the same new principles are given. The new "enforced order" mixer prevents the occurrence of a mix representing an average of widely different extremes of quality, in which the worse qualities determine the overall quality of the mix. 10fig (BCA) Abstr. No. 2843

108

Gilbert, W., and W.L. German

Effect of Chemical Treatment on the Properties of Certain British Clays

Trans. Br. Ceram. Soc. 54, 83

The properties of a series of British building-clays and fireclays have been studied after pH adjustments. Some clays improve in workability and in green and fired strength, but others fail to respond to this treatment. The effects of acids and synthetic polyelectrolytes on the drying characteristics of some clays has been briefly studied, and the beneficial effect noted of adding small amounts of acid to a fireclay mix that was difficult to dry. The brick oil used on clays in some processes slows up drying. 3tab 3fig (BCA) Abstr. No. 2089

109

Jannsen, (NI)

1955 Documents

A Louvered Mouthpiece for Extruders

Silikattechnik 6, 39

A brief note on a patented mouthpiece in which the column is de-aired on its four surfaces. A vacuum chamber surrounds the mouthpiece which communicates with the column through slots. The result is smooth non-cracking surfaces, whilst the desired porosity of the core is retained. 1fig (BCA) Abstr. No. 1654

110

Macey, H.H.

Experiences with an Auger. I.

Br. Clayworker 64, 40

Experiences with a de-airing auger machine using a hard clay of large grain size containing a normal or even high percentage of clay material (it has a high firing-shrinkage) are given. The plastic mix flows under pressure but has no strength. The first auger feeds into a vacuum chamber from which the clay falls into the second auger, which carries it forward and extrudes it. Extrusion from a de-airing machine is more difficult than from an ordinary one because the atmospheric pressure acts as a back pressure of about 5 cwt on the extruded column. The mouthpiece of the auger has a straight taper, lubricated in 8 places at the back. Continental practice favours a mouthpiece that opens away from the auger and is closed by a flat plate. Lubrication is not costly if a suitable oil, e.g., a treated oil is used. Consumption of treated oil in the instance described was about 6000 bricks/gal. With increasing pitch it was found that the heaviest wear occurred on the 10-in. pitch of the feeding portion, the double-wing knife, the part of the 9-in. pitch on either side of it wearing less, and the 8-in. pitch wearing least. Experiments with nickel-chrome cast-iron knives of uniform pitch of 8 in. gave a life of about 850,000 bricks compared with 650,000 for increasing pitch. Five special alloy cast-iron half-knives of 7.6 in. pitch were then substituted for two 9-in. and two 10-in. knives, and gave lives of about 1,700,000 bricks. Barrel friction must always be greater than the back pressure. 5fig (BCA) Abstr. No. 2845

111

Machline, C.

Anomalies in the Mechanical Strength of Green Ware Caused by Extrusion

Ceramica (Sao Paulo) 1, 25

In Portuguese. The dry transverse strength of an extruded ceramic product differs according to the orientation of the test-piece in relation to the direction of extrusion. Eight series of tests carried out with different apparatus and bodies showed that the average differences between test-pieces that have been extruded transversely and those that have been extruded longitudinally range from 6 to 39%. The anomaly is attributed to the orientation of clay particles. 4fig (BCA) Abstr. No. 2143

112

Meeka, E.

The Extrusion Problem

Am. Ceram. Soc. Bull. 34, 51

Points to be observed in the replacement of augers, when raw materials and moisture contents vary, in the design of extrusion dies (preferably symmetrical), bridge setting, taper on former and core blocks, and general balancing of the die. The author's system of protecting core blocks from wear is to sheath them in 1/16-in. thick abrasion-resistant steel. The sheaths were made of steel sheet sheared to the correct width. The outline of the plates was marked with a hammer and cold chisel, the brittle steel being broken by clamping the strip in a vice and snapping it off on the mark with a quick hand motion. The cast-iron or steel block was slightly pre-heated and the plates clamped to the sides of the block with "C" clamps. Overlapping edges of the plates were self-welded with a torch. Approximately 1/4-in. of the plates was allowed to protrude at the back end of the block, this being heated and bent over the back of the block to prevent the sheath from sliding off. Some grinding of the edges was occasionally necessary. The system is easily adapted to dies with comparatively large core blocks. The core block can be made wider on any face by using a thicker plate on that face. (BCA) Abstr. No. 1655

1955 Documents

113

Ortmaier, P.A.

The Kneading-Tempering Machine

Ziegelindustrie 8, 146

Noting the advantages of steam treatment of clays, the author states that this renders weathering unnecessary. The introduction of steam into normal preparation machines, (e.g., bag feeders, tempering-pans, etc.) is considered inefficient. A kneading-tempering machine is described in which the steam-treatment is more effective. (BCA) Abstr. No. 1651

114

Tarasenko, M.S.

Defects and Their Elimination in the Construction of Worm Shafts

Glass Ceram. (Engl. Transl.) 12(1), 15

An involved (distribution of forces, etc.) discussion on the faulty design of auger shafts and bearings in Soviet extruding machines SM-32 and SM-277. The faults lead mainly to deformation of the shafts and damage to the bearings. 6fig (BCA) Abstr. No. 1653

1956 Documents

115

The Vakumat 450 Vacuum Press

Keram. Z. 8, 569

In German. This unit incorporates clay mixer and cutter, vacuum chamber, shredder, vacuum pump with fittings, and extruder. Diameter of the press cylinder is 450 mm. A feature of this machine is push button control. The switch box is on a swinging arm so that the machine can be controlled from each side of the cutter. 1fig (BCA) Abstr. No. 2141

116

New Developments at the German Industrial Fair at Hannover, 1956

Sprechsaal 89, 167

In German. Laeis-Werke A.G. has developed a device for attachment to pugs (normal types or vacuum) which is claimed to prevent lamination. It consists of a hollow sphere which is fixed to the pug in place of the mouth-piece. The sphere has an opening in the direction of the auger and another at right angles to it. The mix enters the sphere through the first opening and leaves it through the second, which is shaped as a mouth-piece. "Shovel blades" fixed to an extension of the auger shaft, rotate inside the sphere. The mix is thus smeared into the mouth-piece, lamination thereby being eliminated. These "shovel blades" are driven (through a reducing gear) by a separate motor and are independent of the pug. Losenhausenwerk Dussel-Axfer Maschinenbau A.G. exhibited various types of vibrators which are designed for compacting mixes. The mixes are put into moulds and placed on vibration plates to retain such a degree of compaction that subsequent pressing causes only a slight additional volume decrease. 18fig (BCA) Abstr. No. 1770

117

Type S 560 Pugmill

Keram. Z. 8, 569

In German. Particularly suitable for the production of large hollow blocks. It can also be supplied as a unit with mixer and vacuum device. This

machine and the Type S 500 can be fitted with double mouthpieces. They can produce 180 x 85 x 55-mm bricks. Type S 500 produces 25,000-28,000 bricks per hour. Type S 560 can reach about 35,000. 1fig (BCA) Abstr. No. 2140

118

Baudran, A.

The Plasticity of Raw Materials and Ceramic Bodies

Silicates Ind. 21, 219

In French. The apparatus used by the Societe Francaise de Ceramique (S.F.C.) is based on Norton's method: a test-piece is deformed at various rates, which are constant during the experiment, under shearing-stresses. The effect of rate of deformation on plasticity was tested between 0.25 and 2 rpm. In certain cases, rupture of the body during shaping can be avoided by increasing the rate. The deformation of bodies after shaping is discussed in relation to published work. If a constant pressure is applied to a test-piece, its rate of deformation will decrease with time. The S.F.C. is proposing to construct an apparatus permitting study of body deformation during the application of pressure and after its removal, and possibly controlling the humidity during the tests. 18fig (BCA) Abstr. No. 203

119

Funke, G.

Hot Preparation in the Ceramic Industry

Ziegelindustrie 9, 225

In German. Hot preparation conduces to faster drying-rates and less power consumption. Drying of hot-prepared clays is facilitated because of the higher initial evaporation, and because the clay is more workable, greater output with less power consumption results. Practical hints for introducing hot preparation into the manufacturing method are briefly but clearly outlined. (BCA) Abstr. No. 1767

120

Jolly, F.W.

Extrusion--An Absorbing Problem

1956 Documents

Claycraft 29, 384

The major cause of pugging problems is the very high friction between the clay and the mouthpiece or spacer or die. The remedy is the introduction of a thin film of oil to the surface of the mouthpiece, well back in the machine, preferably as soon as the clay is clear of the screw. The reduction in power consumption can be as much as 40%. This applies to the horizontal and vertical machines equally and especially to the wing knife. It is suggested that the latter should be the bottom bell type, gradually conforming from the circular to the ultimate shape of the finished article, also that the oil-ring be part of the standard equipment of the modern machine. 3fig (BCA) Abstr. No. 1768

121

Lenz, C.-J.

Hot Preparations of Ceramic Mixes

Ziegelindustrie 9, 715

In German. Advantages of hot preparation (with steam) are discussed. With a steam consumption of 110 kg/ton of ware, power consumption of the pug was reduced by 30%, rate of preparation increased from 4.5 to 5.5 tons/hr, drying-time was reduced by 45%, green-strength increased from 260 to 415 psi, and transverse strength

increased from 160-185 psi. (BCA) Abstr. No. 33

122

Rost, P.P., and V.S. Fadeeva

The Shaping Parts of a Pug

Glass Ceram. (Engl. Transl.) 13(7), 16

In Russian. Improvement in design, at small cost, makes possible a substantial improvement in extrusion. Large, light, highly porous blocks, dense products, thin-walled products (e.g., tiles), and the change to continuous extrusion, e.g., of bell-mouthed pipes can be made. Lubrication is unnecessary, many faults are eliminated, and the strength of the body is increased. Expenditure on power for extrusion decreases and the efficiency of the pug increases. Cast, interchangeable shaping-parts for pugs are considered feasible. 10fig 5tab (BCA) Abstr. No. 34

123

Starkey, D.D.

Basic Design of Augers and Dies

Am. Ceram. Soc. Bull. 35, 116

A short note on the experience of a U.S. clay-machinery manufacturer. Pugs should be fitted with variable gears. For a de-airing pug, the gear ratio should be from 15 to 25:1. A pug making 7,000 bricks/hr should have a propeller at least 16 in. diameter. (BCA) Abstr. No. 1769/56

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124

Controlled Body Preparation

Ceram. Age 70(5), 16

Refers to vitreous floor-tile manufacture. In one system for single-coloured tiles, automatic controls are used primarily for the mixing (comprises a minor and major sifter and blender, an elevator hopper, a 600-lb capacity Lancaster mixer, a hammer-mill and a Lancaster pelleter). Non-plastics are blended with colour stain in a 2:1 to 5:1 ratio. A 40-mesh screen is used prior to blending; 28-mesh is used in the major sifter. Batch materials are blended for 15 minutes, dry-mixed and mulled for 7 minutes. Water is then sprayed for 1 minute, and the batch is wet-mixed for 8 minutes. The mixed batch feeds through a spreader type chute to the pelleter. In the system for mottled tiles, the batch is stored in a plastic-coated wooden car. The granules are covered with discarded filter-cloths and then with a plastic cover which fits tightly over the top of the car. The filter-cloth prevents condensation on the cover and allows storage of wet mix for 7-10 days without detrimental effects. 6fig (BCA) Abstr. No. 1088

125

The Pitch of the Leading Blade in Brick Pugs

Ziegelindustrie 10, 784

In German. The force exerted by the worm on the clay can be resolved into a forward thrust and a turning-force. The resistance to both these forces is mainly friction. The forward thrust must be greater than the turning-force, and on this basis the individual resistance values, the friction of the clay, and the maximum pitch of the leading blade can be calculated. Throughput of clay is directly proportional to pitch. The formulae are explained by a numerical example. (BCA) Abstr. No. 824

126

Allen, W.J., and D.A. Hillman

Torque Measuring on an Extruder

Plastics 22, 423

Refers to an extruder for plastics. The difference in tensions between the tight and slack sides of the v-belt drive to the gearbox was measured. 4fig (BCA) Abstr. No. 826

127

Alt, L.R.

Extrusion Die Problems

Am. Ceram. Soc. Bull. 36, 137

A review of extrusion die problems. A suggested die control programme including die designs, specifications covering satisfactory die materials, precision workmanship and control of external forces which affect die balance. (BCA) Abstr. No. 2142

128

Bloor, E.C.

Plasticity: A Critical Survey

Trans. Br. Ceram. Soc. 56, 423

Results from various types of apparatus (concentric-cylinder viscometer, compression, tension, torsion, indenter) which have been used in testing plasticity illustrate the short-comings of existing definitions. The effect on the yield point of rate of stressing, water content of paste, and thixotropy are considered, and related to the amount of deformation obtainable from a clay paste. The mode of failure of clay in various tests, when understood, allows some estimate of the yield point(s). "Cohesion" and the "angle of internal friction" obtained by tests in soil mechanics are discussed, and related to the angle at which slip planes develop in various materials. The plasticity of clay pastes, the water films between clay particles, consolidation, the effects of alignment of particles, as well as the effect of plasticity of mineral type, fineness, base exchange, and surface tension are reviewed in the light of a wide variety of experimental evidence. This paper draws together the findings of workers in many different fields. 18fig (BCA) Abstr. No. 719

129

Brown, W.S., and I.B. Cutler

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Extrusion of Soft Solids Through a Tube

J. Colloid Sci. 12, 195

Most of the pressure required for extrusion with dies of the dimensions used in this work is due to the entrance effect. Excluding the entrance effect, extrusion of lead and of wax can be correlated by the Eyring plasticity equation. At high flow rates a simplified equation gives a satisfactory correlation between flow rate, pressure, and temperature. 5fig 1tab (BCA) Abstr. No. 2144

130

Draignaud, P.

Comparison of European and American Methods for the Manufacture of Stone-ware Pipes

Bull. Soc. Fr. Ceram. (37), 107

In French. Reviews various set-ups for the preparation of mixtures and feeding the presses in relation to tonnages to be handled, in order to reduce manpower and costs. Although economic results are readily obtained in the preparation process, a high degree of automation is only of value in the shaping-process if the output is large. At present only a few European plants lend themselves to automation because of the cost of the machinery needed. An automatic process used in America is described, and by comparison with traditional European methods, the lowest tonnage at which the process would begin to show a return is determined. 13fig (BCA) Abstr. No. 1092

131

Fearn, N.S.

Cracked Bricks: Some Causes--And Suggestions for Overcoming Them. I.

Claycraft 31, 55

A general survey. To determine which causes are operative at any one time a survey should be made of the material or materials being used, structure of the deposits, noting any features which may have a bearing on production problems, a chemical and physical analysis, and a few simple works tests. (BCA) Abstr. No. 822

132

Fearn, N.S.

Cracked Bricks: Some Causes, and Suggestions for Overcoming Them. II

Claycraft 30, 202

Failing efficient weathering, the mill should be fed with dry pieces c. 2-4 in. by a heavy slow-moving conveyor or worm feed. The level on the dead-plates should be kept at 1/8 in. and certainly not over 1/4 in.; the water required must be added at the back of the mixer immediately behind the raw clay feed and above the level of the mixer shafts, through a pipe or rose with small holes. Starter knives should be used in the first 4 knives on each shaft, and a starter knife is put about every fourth knife on each shaft, right along the top mixer. The pug should be run low with the top knife showing. Knifing practice, pressure adjustment on the presses and weathering are discussed. (BCA) Abstr. No. 1528

133

Fearn, N.S.

Cracked Bricks: Some Causes, and Suggestions for Overcoming Them. III

Claycraft 30, 273

Cracked bricks often occur when air is trapped in the clay as the table-mould is being filled under the pugmill. Elimination of this defect is discussed. Oil cracks can often be traced back to a wrong type of oil, too much oil, dirty oil or oil that is too thick. Pug action and procedure for checking barrel-knives are discussed. Re-knifing is sometimes necessary; procedure for this is given. (BCA) Abstr. No. 1741

134

Fearn, N.S.

Cracked Bricks: Some Causes, and Suggestions for Overcoming Them. V.

Claycraft 30, 450

Procedure for tracing the causes of broken bricks in the kiln is given. Main points are preparation of the material; mixers and water supply, with particular attention to the pugmill; replacement

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of faulty parts and optimum use of the new ones; regular and adequate maintenance of machinery. (BCA) Abstr. No. 2128

135

Fearn, N.S.

Cracked Bricks: Some Causes and Suggestions for Overcoming Them. VI.

Patent No. 27,

Claycraft 30, 484

Defects in hand-mades and wirecuts are caused by faulty preparation of the material, which must be well mixed and all large stones removed; it should then be weathered for 3-4 months before further treatment. Tempering-water should be added progressively, to ensure thorough mixing and even distribution. (BCA) Abstr. No. 27

136

Goodson, F.J.

Clay Preparation at Home and Abroad

Claycraft 30, 595

Summary of a paper presented at a meeting of the Birmingham and District Branch of the Institute of Clay Technology, Birmingham, 15 May 1957. A dry pan is essentially a second grinder. Large lumps of hard material should be first crushed in a primary crusher for high efficiency and output. American practice, where the use of single- and double-roll primary crushers predominates, is described. When winning is by blasting, bucket excavator or dragline, the clay or shale is commonly fed from a surge bin on to a vibrating grizzly screen to remove -2 in., which is fed to storage bins along with material crushed by the primary crusher. German machines and processes are described. At a Swiss works, 2% fine coke, 1-2% sawdust and 1-2% brick dust were added to a fine-grained highly plastic clay: total water content of the clay was said to vary from 25% in the summer to 30-35% in winter. The German system of water control, in which a visual indication is given by the pressure of the oil in a container fitted with a diaphragm in contact with the clay in the spacer, has now been adapted for fully automatic control. The Swiss

have developed an electronic automatic control, and in Britain the British Ceramic Research Association is developing a simple automatic water-controller operated by the clay pressure in the spacer. (BCA) Abstr. No. 1087

137

Haase, T.

The Problems of Plastic Shaping

Ziegelindustrie 10, 781

In German. When a clay column is subjected to a tensile test, deformation is not uniform. Flow proceeds in discrete planes that intersect at about 90 degrees. These planes are also observed when a clay cylinder is slowly compressed, but if it is compressed by impact (as in the Pfefferkorn test), these cracks along shear planes do not appear. Flow during a slow shaping process is essentially different from that during a rapid one. Lamination is attributed to the appearance of these shear planes during slow deformation, and the author believes that it cannot be prevented by altering the design of the mouthpiece, spacer or worm. Lamination would be completely eliminated only if the clay could be extruded 100 times faster than normally. 5fig (BCA) Abstr. No. 823

138

Homayr, J.

Regulating the Water Content of Brick Clays During Preparation and Shaping

Tonind. Ztg. 81, 288

In German. Various methods of determining the water content in clays are critically examined. An apparatus to control the water content of clay while it is being prepared measures the power consumption of a small worm extruder welded to the perforated plates of an edge-runner mill, clay shredder or sieving-kneader as a criterion for regulating the stiffness of the mix. The auger receives more material from the preparation machine than it can extrude, so that complete filling is ensured. Only when the preparation machine runs empty does the auger of the measuring-apparatus begin to be short of clay. Its power consumption drops, which corresponds

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theoretically to too high a water content, and a valve shuts. The regulating device itself consists of a Wattmeter with two limit marks. 5fig (BCA) Abstr. No. 821

139

Kukolev, G.V., and A.N. Korol

Use of Surface-Active Agents on the Production of Ceramic Ware by the Plastic Method

Glass Ceram. (Engl. Transl.) 14(9), 14

In Russian. A formula describes the effect of agents (e.g., soda, a caustic soda extract of straw, ditto of lignite, sulphite lye plus soda, an aqueous extract of straw) on extrusion, which is illustrated by diagrams and tables. It is concluded that suitable additions facilitate extrusion and improve quality. 6fig 2tab (BCA) Abstr. No. 825

140

Neumann, R.

Influence of Grain Fraction Below 2 μ on the Plasticity of Clays and Kaolins and in Relation to the Enslin Value

Ber. Dtsch. Keram. Ges. 34, 274

In German. With clays of the kaolinite or montmorillonite types there are linear relationships between flow limit, Enslin value and percentage of particles below 2 μ . Both Atterberg's plasticity number and the Enslin value of the greater than 2 μ fraction gradually change as finer material is added. Clay minerals occur in that fraction and considerably influence the properties of fine sand and silt. The Enslin value is of value in assessing the plasticity of clays and kaolins. It correlates well with the Atterberg number. On the basis of this relationship a flow limit can be determined directly from the water absorption. 12fig 2tab (BCA) Abstr. No. 720

141

Renault, P.

Preparation of Fine Ceramic Bodies. II. The Correct Use of De-Airing Equipment

Ind. Ceram. (490), 300

In French. Long article on the analysis and theory of lamination faults appearing in soft and hard porcelain bodies, fairly hard de-aired and non-de-aired stoneware, fine stoneware with 50% felspathic sand, semi-porcelain and semi-stoneware body, calcareous earthenware, and earthenware plus alkaline additions. Covers: S, axial and centre cracks and the influence of drying; spiral or pseudo-concentric lamination and cracking; preparation of bodies for the mixer de-airer. 6fig 2tab (BCA) Abstr. No. 827

142

Renault, P.

Preparation of Fine Ceramic Bodies. III.

Ind. Ceram. (491), 335

In French. Deals with the casting of blanks for electroceramics or other solid parts, importance of the nature and consistency of the body, and role of the de-airing equipment. It is the nature and consistency of the material and not the de-airing that determine the quality of the products. Once effective working conditions have been determined, they should be recorded and controlled during future production. Even if the test-pieces are smaller than in works practice, the method of testing by extruding solid cylinders, dividing them into slices of different thickness and length, and drying them under differing conditions can give useful information on the behaviour and value of a body subjected to de-airing. 4fig 2tab (BCA) Abstr. No. 1089

143

Renault, P.

Preparation of Fine Ceramic Bodies. The Correct use of Deairing Equipment. I.

Ind. Ceram. (489), 262

Discusses body preparation, factors affecting body consistency during working, blunging and wet mixing under vacuum, testing equipment, and raw materials. Tests on homogenization, change in consistency, cracking, and warping are described. Two porcelain bodies were used—one white and fairly soft, the other firmer and black (it contained Blin clay from the Seine-Maritime). 7fig (BCA) Abstr. No. 548

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144

Robinson, G.C., and J.J. Keilen

Role of Water in Extrusion and Its Modification by a Surface-Active Chemical

Am. Ceram. Soc. Bull. 36, 422

The amount of water for extrusion influences extrusion speed, plastic strength, dry strength, fired strength, fired absorption, and total shrinkage. The correct proportion of water would give optimum results for all these properties. Addition of a surface-active chemical doubles the dry strength and increases rate of production by 77%. 13fig 6tab (BCA) Abstr. No. 1090

145

Rosenthal, E.

Manufacture of Perforated Bricks at the New Brickworks Gebr. Loehlein, Berlichingen

Claycraft 31, 39

Ziegelwerke Berlichingen produces 12 million perforated bricks yearly with 17 men. Two clays are used (one lean, one plastic) mixed together in

the ratio 1:1. Manufacturing process is described. Of note is the Lingl automatic rotary cutter which has cutting-wires fixed between two revolving chains. According to the length of the article required, 10, 6, or 3 wires were stretched between the two chains, producing 14,000, 8,000 and 4,000 bricks or slices per hour. When in cutting position, the wires are guided and stretched by a slot in the frame, fixed on the sliding table of the pug, and inclined at an angle that depends on the speed of the extrusion, to ensure a clean cut. Perforated bricks are fired at 1,050 degrees, facing-bricks at 1,100 degrees. The kiln is 114 ft long with a cross-section of 6 in. x 6 ft. Passage takes 30-40 hours. 10fig (BCA) Abstr. No. 829

146

Sigrist, E.

Lecture on Cutting-Off Devices

Ziegelbau 7, 35

In German. Numerous cutters (designed by Firma Georg Willy, A.G.) for bricks, hollow blocks, drain pipes, etc., are described. 16fig (BCA) Abstr. No. 2145

1958 Documents

147

New Method for Handling Green Clay Pipes at Mellody's Pottery

Clay Prod. J. Aust. 25(12), 18

The use of Al cradles for handling large sewer pipes while green is described. 4fig (BCA) Abstr. No. 891

148

Homayr, J.

The Cause and Cure of Lamination in the Extrusion of Brick Materials

Trans. 6th Int. Ceram. Congr., Weisbaden, 1958, p. 441

In German. Three factors govern the formation of lamination in the shaping of clay products: the deformability of the material being shaped, its degree of heterogeneity and the relative movements occurring on deformation. By estimating these factors the materials employed in the brick and tile industry can be classified into groups that can be processed using the same methods, so that by observing certain conditions there will be a minimum of lamination. The investigations also establish the principles for the design of the extrusion machines to be used for each group. The principles are completed by notes on the "external characteristics" of extrusion machines and the effect of the friction coefficients--clay on steel and clay on clay--on the extrusion of the brick materials. On the basis of the data, advice on how to limit the occurrence of lamination can be given. The effect of the degree of heterogeneity on formation of laminations is illustrated by means of an example. On the other hand, eliminating lamination that is already present is quite a different problem from that of the formation of laminations. 10fig (BCA) Abstr. No. 1831

149

Lawrence, W.G.

Factors Involved in Plasticity of Kaolin-Water Systems

J. Am. Ceram. Soc. 41, 147

The plastic properties of kaolin-water systems may be increased by: (1) decreasing the charge on particles by changing the clay to a type that does not have a monovalent cation adsorbed on the particle; (2) avoiding additions that lower the surface tension of the water; (3) increasing the rigidity of the adsorbed water structure by avoiding monovalent cations. This is in addition to the charge effect discussed previously; (4) maintaining normal temperatures rather than high temperatures during forming-processes; (5) decreasing the particle size or adding extremely fine particle-size material such as montmorillonite, preferably of the calcium variety, owing to the charge effect discussed. 5fig 1tab (BCA) Abstr. No. 2134

150

Nelson, J.A.

Rheological Properties of the Clay-Water System Under Pressure

Diss. Abstr. 19, 1034

Thesis: Univ. of Illinois, 1958

Pressure within the system is induced by the externally applied forces required in forming-processes such as extrusion. Thus it is important to understand the effect of pressure on the rheological behaviour of plastic clay. Equipment was designed and constructed which made it possible to determine the pressure distribution in plastic clay. Another apparatus constructed was found to be satisfactory for determining the forces required to shear plastic clay within its own structure or to bring about slippage or a combination of slippage and shear at a clay-metal interface at various pressures and speeds. It was found that when an external pressure was applied to a plastic clay so that within its entire structure stresses existed which exceeded its yield value, then an increase in applied pressure was transmitted in a direct proportion to other points in the plastic clay. Curves were obtained for Florida kaolin, Fulton plastic fireclay, and Danville shale showing the relationship of the torque required to turn a smooth, metal rod in plastic clay to the clay pressure and speed of

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rotation of the rod. Similar curves were also obtained where the clay sheared within its own structure instead of at a clay-metal interface. Comparison of the curves for clay of the same consistency was used to indicate the extent of the slippage in the case of the smooth metal rod. In general the torque/pressure curves showed an increase in torque until a certain pressure had been reached, and then it became practically constant. Torque increased with speed of rotation of the metal rod. When the water content was just sufficient to fill the pores between the clay particles or lower, there was a great variation in the torque with small changes to the amount of water. In comparison, when the water was in excess of that necessary to fill the pores, the torque did not show much variation with large changes in water content. Addition of round-grain blasting-sand (20-40 mesh U.S. Standard screens) to Florida kaolin were shown to increase the torque required to turn a smooth metal rod in plastic clay almost directly proportionally to the amount of sand added. (BCA) Abstr. No. 1492

151

Robinson, J.S.

Die Lubrication

Claycraft 31, 202

Concerns extrusion dies of rectangular section only. For a well-formed, perfect column, the mouthpiece and die should be well-balanced and

designed so that there is a smooth unbroken flow without any step or lip between the two. Corner lubrication has reduced oil consumption from 5,000 to 20,000 bricks/gal. The most suitable oil is the thin, diesel type "brick oil," which should be applied to the 4 corners. 4fig (BCA) Abstr. No. 1769/58

152

Stawitz, J.

Cellulose Derivatives in the Ceramic Industry

Ber. Dtsch. Keram. Ges. 35, 56

In German. A survey of uses of methyl cellulose (MC) and carboxymethyl cellulose (CMC). The latter is used in glazes and engobes as a suspending agent, or as an adhesive to improve glaze adherence. Organic colloids can be used as plasticizers or for increasing the green strength. SiC bodies can be plasticized with 0.2-1.0% MC and thus rendered extrudable. Since MC burns out almost without residue, the electrical properties are not affected. 3fig (BCA) Abstr. No. 1561

153

Woolley, E.

Control of Brick Sizes. II.

Claycraft 31, 205

Preparation of quality-control charts recording weekly changes. 3fig (BCA) Abstr. No. 1770/58

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154

Denver Brick Setting Die Life Record with New Ceramic Lining

Brick Clay Rec. 135(1), 54

The life of a new pipe-machine die and bell liner made of Coors high-alumina ceramic, in use by the Denver Brick and Pipe Co., is expected to be 400,000 ft of 8-in. pipes. The die body is of case-hardened steel and has a ceramic core, liner and ring, which, if the rate of wear from the 80,000 4-ft lengths of pipe already made is maintained, are expected to last 10 to 17 times longer than any normally used. 140 yd³ of clay are saved between die-liner changes and the pipe walls continue to remain smooth for more than 100,000 lengths. The wall thickness should also be well within the close tolerances demanded by modern plastic joints. The problem of the tipped socket has been greatly reduced, and dry loss has decreased. Ceramic sores have also been made for the extrusion of hollow blocks and have outlasted high alloy steel ten times. 3fig (BCA) Abstr. No. 263

155

Oiling the Clay

Esso Oilways 10(1), 7

Refers to the use of Esso Brick Oil No. 1 to prevent ribbons of clay, extruded for floor-tile production, from sticking together. 1fig (BCA) Abstr. No. 1594

156

Baudran, A., and C. Deplus

Rheological Behaviour of Clay Bodies

Trans. Br. Ceram. Soc. 58, 454

The fundamental properties that characterize rheological behaviour are considered, and an original laboratory apparatus designed to study these properties is described. With this apparatus tubular test-pieces are deformed in torsion, and the values of deformation and of force exerted are recorded simultaneously. At any point during a test the force applied to a test-piece can be removed. In the same way the value of the deformation at a given instant "t" can be

maintained constant for any period "T". Tests carried out with the apparatus enabled the following conclusions to be drawn: (1) the greater the angle of rupture of a body, the better its workability; (2) for shaping by extrusion, turning or hand-moulding, the yield stress must be as high as possible in order to avoid the deformation of pieces under their own weight, or when being handled immediately after shipping. A study of different types of deformation reveals recoverable or elastic deformations which depend chiefly on the total deformation. These deformations are responsible for internal making-stresses; the zones of greatest deformation are liable to cause zones of less deformation to flow when the stress due to elasticity exceeds the yield value of the body. In this way it is possible to determine the sensitivity of a body by its post-shaping deformation. (BCA) Abstr. No. 188

157

Bernt, E.

Improving Plasticity

Ziegelindustrie 12, 480

In German. Includes effects of fine grinding, moisture content, hot preparation, de-airing, base exchange, additives. (BCA) Abstr. No. 259

158

Bloor, E.C.

Plasticity in Theory and Practice

Trans. Br. Ceram. Soc. 58, 429

Clay materials owe their plasticity to fineness, to platiness, and to crystal and surface structure as it affects water films round the plates. The effect of pH and electrolytes on charges arising from isomorphous substitution within the crystal lattice, and at fractured edges of plates, are related to changes in the type of flocculation in acid and alkaline conditions, and to such features as water retention, dry clay density, and dry strength. Anisotropy of structure produced by flow can be detected by a peel technique. The difficulties and results of laboratory tests are considered. From these tests the best index of plasticity appears to be the strain, not the stress, at the yield point or

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the maximum stress. Laboratory tests, though useful for distinguishing raw materials, may fail to reveal more subtle effects that occur in production, owing to day-to-day variations in processing. More knowledge of the clays used and more accurate control of the water content of bodies are indicated. Alignment of particles results in unequal drying and firing shrinkages in three dimensions, so producing built-in stresses that cause distortion and cracking. Coloured clays show the pattern of flow which, in conjunction with contraction figures, can be used to interpret the direction of alignment of the clay particles. 7fig 4tab (BCA) Abstr. No. 187

159

Colwell, R.E., and K.R. Nickolls

The Screw Extruder

Ind. Eng. Chem. 51, 841

The estimating of extruder performance requires a knowledge of velocity and temperature distributions in the screw channel with various downstream resistances. Heat generation and conduction markedly influence the performance of typical thermoplastics extruders. A method is presented for calculating the steady-state temperature and velocity profiles for non-Newtonian flow between parallel plates with a pressure gradient and relative rectilinear motion. Heat generation due to laminar shear and heat transfer by conduction to the boundary surfaces are taken into account. The typical steady-state extruder performance curve is a sigmoidal. Correction factors characterizing the departure from the simple isothermal-Newtonian model are presented for a commercial polystyrene melt. 5fig (BCA) Abstr. No. 22

160

Detaille, H.

The Problem of Lamination and the Rheological Properties of Clay

Silicates Ind. 24, 370

In French. Suggestions on the possible relationship between lamination in shaped clayware and the plate-like character of clays. 13fig (BCA) Abstr. No. 260

161

Gilbert, W.

Some Problems of Manufacture by the Wirecut Process

Trans. Br. Ceram. Soc. 58, 629

It appears that the amount of inert material such as grog in the clay body will have a considerable effect on the physical properties of the extruded body. For each specific body the degree of vacuum is critical, because strength does not increase linearly with the increase of vacuum. Apart from the fundamental change in ultimate strength with increasing degree of vacuum, there is a large increase in the working plasticity of the column, which is indicated by the length of column extruded before it ruptures under its own weight. Further experiments in the extrusion of bodies containing a high percentage of non-plastics is necessary before general opinions can be expressed. The effect of non-plastics on auger laminations must be observed over a wide range of bodies containing clays of various origins, of varying non-plastic content and fired at various temperatures. The design and lubrication of the die in the de-airing wirecut process will also affect process losses, the properties of the fired body and service behaviour. This work is part of a study to rationalize the de-airing wirecut process mainly in terms of: degree of vacuum; design of the de-airing auger machine; design of the die; design and co-ordinate of the bulk; co-ordination of off-bearing belt or take-off mechanism for conveying to represses. 7fig 1tab (BCA) Abstr. No. 170

162

Gmeiner, A.

Organic Binders Increase Strength of Clay Bodies

Brick Clay Rec. 134(6), 61

The advantages claimed for the use of chemical additives in brickmaking are noted, and in particular for lightweight blocks. A small unit has been developed that will produce a good lightweight aggregate from a great variety of materials at a reasonable cost. The machine is a

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small, compact, underfeed sintering-hearth with recuperation of the exhaust gases. The primary fuel is mixed with the raw clay or shale, and natural gas is used as secondary fuel to control the combustion process. (BCA) Abstr. No. 264/60

163

Goodson, F.J.

Experiments in Extrusion

Trans. Br. Ceram. Soc. 58(3), 158

The flow of clay in a fully instrumented experimental extruder, which gave continuous readings of thrust, torque and rate of extrusion, has been studied. It could be fitted either with blades or with a complete auger. Clay being extruded from the die behaves as a Bingham solid, having a definite yield stress which depends only on the nature of the clay. For a given clay in a given machine, the yield stress varies only according to the water content. Above the yield stress, the rate of extrusion, from zero to maximum, is directly proportional to the increase in thrust or pressure above the yield value. The actual value of maximum rate of extrusion for any clay depends on its physical properties and also on the geometry of the machine and the speed of rotation, and varies with speed of rotation, to a first approximation, according to the equation, $Q = AN - BN^2$. An attempt is made to explain this in non-mathematical language by means of the idea of drag flow and back-pressure flow. The optimum blade angle for bladed pugs, and the mean helix angle for augers, is shown to be about 23 degrees, which gives both maximum rate of extrusion and maximum efficiency of extrusion. The effect of scale factor is given, based on dimensional analysis, so that if tests are made on a model machine the results can be applied to a full-size machine by multiplying the results by the appropriate factor. 18fig (BCA) Abstr. No. 2751

164

Goodson, F.J., and H.R. Hodgkinson

Extrusion Research

A.T. Green Book. Stoke-on-Trent, UK: Brit. Ceram. Res. Assoc., p. 269

The results of a study of the flow of clay in a fully-instrumented laboratory pug are summarized. They led to the development of automatic water-control for brick plants. The effects of variation in the design of pugs upon their performance are discussed, and the origins and causes of laminations are considered. Efforts directed towards rendering them innocuous are described. 5fig (BCA) Abstr. No. 1139

165

Henkel, D.J.

Relationships Between Strength, Pore-Water Pressure, and Volume-Change Characteristics of Saturated Clays

Geotechnique 9, 119

For triaxial compression of extension tests on saturated remoulded clays, unique relationships exist, at failure, between water content, strength, and average principal effective stress. The relationships are independent of whether the tests are made on drained or on undrained samples, but normally consolidated and over-consolidated samples must be considered separately. The existence of these relationships enables the strength and pore-pressure changes in undrained tests to be predicted from the results of drained tests. 20fig (BCA) Abstr. No. 172

166

Kukolev, G.V., and N.V. Pitak

The Effect of Deflocculants on Pug Efficiency in the Shaping of Earthenware Bodies Incorporating Kaolin and Bentonite

Steklo i Keramika 16(7), 7

In Russian. Additions of bentonite to kaolin and earthenware bodies considerably increase pug efficiency and reduce the power consumption. The effect is still greater if certain deflocculants are introduced (Na_2CO_3 and soda extracts from peat and straw were used.) The thickness and physical properties of the water films round the clay particles are closely connected with the structural and mechanical properties of slips and earthenware bodies, and determine their

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behaviour during extrusion. 5fig 2tab (BCA) Abstr. No. 261

167

Leusden, R.P.

New Developments in Preparation, Shaping and Drying. I and II.

Ziegelindustrie 12, 364, 411

In German. Plasticity and lamination of clay are considered in detail. Hot preparation is said to have a number of advantages, the chief one being that faster and safer drying is possible. The application of hot preparation in an "ideal" automatic works is outlined. 13fig (BCA) Abstr. No. 258

168

Levine, S.

Mixing Equipment for Ceramic Materials. I.

Ceram. Age 73(6), 23

Mixers are classified according to function and type. Sixteen types are listed, with the principle on which each operates. 15fig 7tab (BCA) Abstr. No. 2750

169

Levine, S.

Mixing Equipment for Ceramic Materials. II.

Ceram. Age 74(1), 24

Discusses "change-can" mixing units, the Colton pony-type paste mixer, the angular mixer, the Duplex dispenser, ribbon mixers, spiral blade mixers, horizontal paddle-type batch-mixers, and kneaders. 13fig 3tab (BCA) Abstr. No. 257

170

Nelson, J.A., and A.I. Andrews

Rheological Properties of the Clay-Water System Under Pressure

Am. Ceram. Soc. Bull. 38, 447

Equipment for determining the forces required to shear plastic clay within its own structure or

to bring about slippage or a combination of slippage and shear at a clay-metal interface at varying pressures and speeds. The method involved either a smooth or a splined metal rod, and the torque applied to the rod as it rotated in plastic clay in a closed system could be measured. Apparatus was also constructed to measure the pressure exerted by plastic clay when it is acted upon by an externally applied force. Curves for several clays relating torque to clay pressure and speed of rotation of the rod under conditions when clay sheared on clay or when slippage could take place at the interface showed that torque increased with increase in pressure until they became practically constant at some pressure that depended upon the water content of the clay. In general the torque also increased with speed. 16fig (BCA) Abstr. No. 23

171

Parks, J.R., and M.J. Hill

Design of Extrusion Augers and the Characteristic Equation of Ceramic Extrusion Machines

J. Am. Ceram. Soc. 42, 1

Although there is empirical knowledge on the subject, no method has yet been proposed by which values may be assigned to the design parameters of an auger so that there may be reasonable assurance that it will extrude a material, the plastic properties of which may be known. A model is proposed for the operation of an auger on a material and adapts the theory of the screw-conveying of solids in extrusion machines for organic thermoplastics to the study of this model. The concept of the characteristic function, which describes the action of a particular extruder on a plastic material, is discussed. 5fig 3tab (BCA) Abstr. No. 1593

172

Robinson, G.C., and J.J. Keilen

The Role of Water in Extrusion and Its Modification by a Surface Active Chemical

Br. Clayworker 67, 267

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Tables give: the fired properties of a body (%: ball clay, 40; feldspar, 25; flint, 35); the effect of water and Na lignosulphonate on the extrusion and dry properties of a body containing (%): kaolin, 40; ballclay, 10; prophyllite, 25; flint, 25. The effect of Na lignosulphonate on the properties of moistened shale (0.4%) can double the dry strength; 0.2% increases fired strength by 63%. The amount of water for optimum results is influenced by surface-active agents. 1fig 3tab (BCA) Abstr. No. 1806

173

Samsonov, G.V., and P.S. Kislyi

The Technology of Manufacturing Tubes and Rods from Molybdenum Disilicide

Ogneupory 24, 276

In Russian. A new method of pressing MoSi_2 powders (for thermocouple sleeves, heating-elements, etc.) combines pressing by friction with extrusion. 3fig 1tab (BCA) Abstr. No. 24

174

Seanor, J.G.

De-airing. III.

Brick Clay Rec. 134, 70

Discusses vacuum piping, use of a filter, use of long radius bends instead of tees and crosses, leakage of packing round the driving shaft, clogged valves, and the installation of a check valve. The author can find no authoritative information on the volume of air, water-vapour and other minor gases that are removed from the clay in the vacuum system, and believes that for heavy-clay products the volume of air, etc., to be provided for is 0.004-0.01 ft^3/lb of water. If over 0.01 ft^3/lb is encountered it is usually traceable to air leaks into the vacuum system. (BCA) Abstr. No. 2340

175

Seanor, J.G.

De-Airing. IV.

Brick Clay Rec. 134(5), 77

Sealing of the vacuum in the de-airing chamber is discussed. A procedure for tracing air-leaks is given. 1fig (BCA) Abstr. No. 2752

176

Seanor, J.G.

De-Airing. V.

Brick Clay Rec. 134(6), 49

Hollow building-blocks made in a de-airing pug dried more quickly than normal blocks. It is stated that there is only a very small undetectable amount of air in a clay that is processed at a pressure of 1 in. absolute, or less, regardless of the fineness of shredding. To prevent clay sticking, the inner surfaces of the vacuum chamber are cleaned with an emulsified wax (of the floor-polish type). One manufacturer avoids dry crumbs and crumbs of semi-leather-hardened clay in his product by tapping into the side of the vacuum chamber and installing small nozzles through which thin streams of water are periodically and intermittently sprayed at high pressure onto places where clay is beginning to stick. (BCA) Abstr. No. 262

177

Seanor, J.G.

De-airing. I.

Brick Clay Rec. 134(2), 45

A fairly long paper on theory and practice, with a view to aiding the plant operator. 1fig (BCA) Abstr. No. 1807

178

Zwetsch, A.A.

Lamination in Ceramic Bodies

Ber. Dtsch. Keram. Ges. 36, 388

In German. The regular pattern of ancient craquelée glazes is taken as an indication that the body below the glaze was free from inhomogeneity and directional texture. The variation in thermal expansion of test-pieces taken from different parts of an extruded column was measured, as well as variations in the thermal expansion of test-pieces cut in different direc-

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tions from other fired bodies. 8fig 3tab (BCA)

Abstr. No. 171

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179

Clark, J.L.

Multicores Die Cuts Brick Weight

Brick Clay Rec. 137(1), 48

Tests on dies for modular and for Norman bricks have enabled savings to be made in clay, fuel, firing-time, handling, and shipping. The 8-in. modular die has 21 diamond-shaped cores $5/8 \times 3/8$ in., and 14 round cores $1/4$ in. diam. It produces ware with a minimum wall thickness of $3/8$ in. wall and about 28% perforations. The Norman-type die has a curved shaper cap. The nearer the centre the longer the core stem. It has 35 $5/8 \times 1$ -in. diamond-shaped cores and 22 $1/4$ in. diam round cores. The percentage of perforations is 34%. 6fig (BCA) Abstr. No. 252/61

180

Dale, A.J.

Modern Ceramic Practice

Ceramics (London) 11(133), 10 (Pt. 1); 11(134), 24 (Pt. 2a); 11(135), 19 (Pt. 2b); 11(139), 15 (Pt. 4); 11(140), 46 (Pt. 5); 11(141), 17 (Pt. 6); 11(142), 25 (Pt. 7); 12(143), 28 (Pt. 8); 12(144), 26 (Pt. 9); 12(145), 33 (Pt. 10); 12(146), 21 (Pt. 11); 12(147), 30 (Pt. 12); 13(157), 23 (Pt. 22); 13(158), 34 (Pt. 23); 13 (159), 23 (Pt. 24)

1960-1962

A long series dealing with such topics as: basic physical and chemical laws; structure and properties of ceramic materials; flexible or unbreakable ceramics; control and selection of ball clay; non-plastics in ceramic mixes; slip-house machines and blunging conditions; mixed body preparations by slop methods; "dry" mixes; unusual occurrences in ceramic slips and plastic bodies; drying; raw body influence on fired properties; protective production and quality testing; instrumentation; and costing systems.

181

Everhart, J.O.

Thoughts on Die Design

Ceram. Age 76(3), 29

In most cases an approach taper of 30-45 degrees produces the best results, and the taper of the die should be 1-4 degrees. Length of finish is best when it is 3-4 times the wall thickness. Absorption of a shale brick was reduced from 8-6% with a strength increase of 15% by placing a 2-1/2 degree taper in a 3-inch finish. All sharp corners should be radiused between the end of the barrel and the die. (BCA) Abstr. No. 544/61

182

Hallmann, E.

The Calculation of Augers for Materials Composed of Solid Particles. I.

Ziegelindustrie 13, 321

In German. Equations are derived for calculating the conditions of pressure within the flights of augers, power consumption, throughput, and axial thrust for various clay materials and various operating conditions. 14fig (BCA) Abstr. No. 2414

183

Hallmann, E.

The Design of Augers for Materials Composed of Solid Particles. II.

Ziegelindustrie 13, 627

In German. Calculations for the pressure required at the die and for the development of pressure in the spacer. Calculations are given for designing an auger machine. 7fig (BCA) Abstr. No. 543/61

184

Ormsby, W.C.

The Role of Surface Tension in Determining Certain Clay-Water Properties

Am. Ceram. Soc. Bull. 39, 408

The experimental evidence supporting the so-called stretched membrane theory of plasticity is re-examined in some detail and found to be incomplete. Generalizations based on this evidence are therefore open to question. 4fig 1tab (BCA) Abstr. No. 183/61

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185

Owen, V.J., and W.E. Worrall

An Extrusion Method for the Testing of the Flow Properties of Plastic Clays

Trans. Br. Ceram. Soc. 59, 285

The flow properties of clay paste depend on: the clay mineral itself, its moisture content, the particular ion associated with the clay, and any non-plastic substance mixed with the clay, whether naturally occurring or added deliberately. As the rate of shear increases, the clay aggregates are broken down. The extent of break-down increases with shear rate, and at very high rates of shear the clay probably behaves as discrete particles. This transition from aggregates to individual particles accounts for the progressive decrease in viscosity along the bottom bend of the D/T curve. Thus H-clays and Ca-clays, which consist of aggregates, have large "bottom bends," whereas Na(plus) clays, which consist of individual particles, have little or none. As the rate of shear of a clay-water system becomes very great, the viscosity tends to a constant value. In this case the clay aggregates are completely broken down, and the individual particles align themselves in the direction of shear, the degree of alignment depending on the shear rate. Particles which are either flat plates or elongated needles will offer less resistance to a shearing force once they are aligned, so in this case the viscosity will be low for high rates of shear. This accounts for the high final slope for bentonite ("platy" particles) and the lower final slope for the China clay (chunky, book-like particles). 18pp 3fig 7tab (BCA) Abstr. No. 206/61

186

Stapenhorst, H.

Evaluation of the Effect of Hot Preparation on Plasticity

Ziegelindustrie 13, 777

In German. An apparatus is claimed to measure the effect of heat on the plasticity of clay. It enables the optimum temperature for hot preparation to be assessed, and information to be provided whether, and to what extent, plasticity can be improved by hot preparation. Examples are given with different kinds of clay. 11fig (BCA) Abstr. No. 1753/61

187

Stutzky, E.

Combating Faults in Mechanical Shaping

Ziegelindustrie 13, 504

In German. To reduce "S" cracks, the following measures have been found successful: (1) intensive preparation of raw material to produce a homogeneous mix, (2) additions of grog composed of angular grains, (3) shaping the clay when it is as soft as possible, (4) installing a device over the die to destroy lamination patterns. In hollow-block manufacture, the shape of the die should be modified to eliminate "dog-ears". "Brakes" fixed to the die can ensure that the flow of clay is uniform across the column. The souring of batts is recommended for reducing faults in roofing-tile manufacture. 12fig (BCA) Abstr. No. 542/61

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188

British Ceramic Research Association

Pugging and Extrusion Research, 1958-1959

Claycraft 35, 88

This report deals with extrusion under the headings of the effect of the machine itself, the fundamental nature of the deformation of plastic clay, and the flow of clay through the spacer and die. (BCA) Abstr. No. 1385/62

189

Fadeeva, V.S.

The Formulation of Ceramic Batches According to their Formability

Glass Ceram. (Engl. Transl.) 18, 399

The maximum pressure on the clay in a pug is about 30 psi when making solid bricks, 85 psi for hollow blocks and 140 psi for tiles. A graph shows the range of making pressures for each of the standard shaping-processes, and a testing device, depending on the forcing of the clay between two cones, is described which indicates how to obtain, from that clay, a body suitable for shaping by a particular method. 2fig (BCA) Abstr. No. 1874/62

190

Lundina, M.G., and K.I. Rostovtsev

Mass Production of Structural Ceramic Blocks

Glass Ceram. (Engl. Transl.) 18, 294

In the "packet" method of forming thin-walled hollow blocks the mouthpiece is designed so that block-packets of 16-20 blocks or more can be formed. The blocks are arranged in pairs, facing side inward, to prevent discoloration, contamination, and destruction of the face surfaces. With one deairing pug 200,000-500,000 m² can be made per year. Blocks formed by the packet-forming method can also be used for producing glazed coloured ceramics for facades of buildings. 4fig (BCA) Abstr. No. 1386/62

191

Milde, C.

Current Practical Experience in Hot Preparation and Hot Shaping with Reference to the Application of Existing or New Machines and Its Effect on Drying Techniques

Ziegelindustrie 14, 40

In German. Steam treatment has been found successful at many works. Various methods are outlined for applying steam treatment according to the kind of raw material and its initial moisture content. Methods recommended for eliminating faults occurring during hot extrusion, and practical hints are given for drying hot-extruded ware. (BCA) Abstr. No. 1754/61

192

Niesper, A.

Rhythmic Clay Drying

Ziegelindustrie 14, 173

In German. Detailed description of the Rotomix-air system of drying, emphasizing its versatility. 23fig (BCA) Abstr. No. 1757/61

193

Spicak, K.

The Pressing of Fireclay Bricks of High Grog Content

Silikaty 5, 324

In Czech. (Abstract not available.) 2tab (BCA) Abstr. No. 1387/62

194

Tarpley, W.B., K.H. Yocom, and R. Pheasant

Ultrasonic Extrusion: Reduction in Vehicle and Plasticizer Requirements for Non-Clay Ceramics

Aeroprojects, Inc. Report No. NYO-10006

Earlier work on the ultrasonic extrusion of lead and aluminum has been extended to the cold extrusion of plasticized ceramic compositions, resulting in significant improvements in increased extrusion rate (more than 100-fold), and in

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extruded specimen properties. It has also been found possible to extrude materials which are normally nonextrudable because of their low plasticizer or water content. Fused ground alumina could be ultrasonically extruded with 15% less water than the minimum content without ultrasonics, and only 40 to 60% of that used in normal commercial practice. Significant improvement in the strength of as-extruded shapes, as well as reduced shrinkage and deformation in drying and firing, resulted. Compositions normally using 3 w/o ammonium alginate as a plasticizer can be extruded with 0.2 w/o plasticizer when ultrasonically activated. It has been postulated that the ultrasonic effects observed are derived from reduction of surface friction, shear thinning of the thixotropic systems, particle orientation, surface film rupture,

and wetting phenomena. Extruded specimen improvement was evidenced by a smoother surface and freedom from cracks, tearing, and peeling. When steel dies were used, abrasion of the die surface sometimes caused a superficially discolored surface in nonultrasonic extrusions. The comparable ultrasonic extrusions showed little or no discoloration as the ultrasonic power level was increased. Ultrasonically extruded specimens which were fired in the same kiln loading as their corresponding controls show small but consistent increases in fired density. Water absorption was approximately 75% of the control. The highest moduli of rupture in the fired specimens were found in the ultrasonic specimens even though these required only 25% of the extrusion pressure of the controls. (Author)

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195

How One Man Grinds Clay for Three Plants

Brick Clay Rec. 141(2), 72

Globe Brick Co., Newell, W. Va., has a grinding-room automatically controlled by one operator. The heart of the system is the control panel, which enables two grinding circuits to be operated automatically or individually as desired, each having a capacity of 50 tons/hr. 3fig (BCA) Abstr. No. 15/63

196

Arimori, T., and A. Konishi

Relation Between the Operating Conditions of the Hydrocyclone and the Removal of Iron Content

J. Ceram. Soc. Jpn. 70(1), 23

In Japanese. Refers to the removal of pyrite from china stone. 8fig 8tab (BCA) Abstr. No. 916/63

197

Astbury, N.F.

The Problem of the Clay Column

Claycraft 36(2), 40

An introduction to reports of a programme of work, carried out by the British Ceramic Research Association, directed towards the provision of practical means for the elimination of "laminations" in wire-cut bricks. (BCA) Abstr. No. 918/63

198

Astbury, N.F., and F. Moore

A Contribution to the Study of Plasticity

Trans. 8th Int. Ceram. Congr., 1962, p. 3

Describes experiments on the cyclic stressing of clay bars in torsion and establishes the phenomenon of hysteresis. The hysteresis loops, obtained with shear stresses up to 200,000 dynes/cm², are not elliptical, as they would be for a simple viscoelastic material, but have a characteristic shape reminiscent of that of ferromagnetic hysteresis loops. The dependence of the loop area on moisture content and the nature of the clay mineral

is discussed. The observed behaviour is compared with that of a hypothetical material consisting of elastic and viscous components, the ratio of the concentrations of which is determined by stress, through a distribution function involving an intrinsic energy of breakdown. It is shown that this model gives essentially the correct form of hysteresis loop and that with it certain characteristic compliance coefficients can be derived from the experimental loops. An estimate of the intrinsic breakdown energy is made, and a value of the order of 1,000 ergs/cm³ seems likely. A suggestion is made that the compliance coefficients, one of which determines high-stress behaviour and the others low-stress behaviour, might be relevant to a definition for technical plasticity, and it is further suggested that a hysteresis loop does in fact contain much of the information relevant to the working of clay and that it is the object of any model to extract this information. 12fig 3tab (BCA) Abstr. No. 2416/62

199

Eardin, C.

A Plasticity Meter for Works Control

Silicates Ind. 27(9), 419

In French. A study of available methods of assessing plasticity leads to the retention of the process of simultaneous measurement of stress by torsion. A simple, strong instrument applying this principle is described, designed for factory control by the Services des Etudes et Recherches Techniques et Industrielles de la Societe Francaise de Ceramique. 14fig (BCA) Abstr. No. 1110/63

200

Chapman, R.A.

How to Lubricate Mould Box Liners

Brick Clay Rec. 141(2), 45

A note on a Boyd dry-press making refractories. 1fig 1tab (BCA) Abstr. No. 682/63

201

Griffith, R.M.

1962 Documents

Fully Developed Flow in Screw Extruders

Ind. Eng. Chem. Fundam. 1(3), 180

Differential equations are presented for the thermally and hydrodynamically fully developed flow of an incompressible fluid in a metering screw. A method of numerical integration and some results therefrom are described for a "power law" fluid. The numerical results agree with experimental data obtained for comparison. 15fig (BCA) Abstr. No. 681/63

202

Hiendl, H.

Bowless Mouth Piece: A Modification of the Method of Supporting the Core in the Mouth-Piece

Ziegelindustrie 15(18), 639

In German. The "bow" supports the core used in the extrusion of perforated bricks. These supports, which are normally fixed to the spacer, increase friction and give trouble. With one body the friction was so great that water was squeezed out of the material. The core was therefore fixed to the auger, rotating with it and diminishing friction. 2fig (BCA) Abstr. No. 921/63

203

Hodgkinson, H.R.

The Mechanics of Extrusion

Claycraft 36(2), 42

The experimental clay-rolling machine used had a pair of rolls 2 ft diam x 3 in. wide, one vertically above the other, both rolls being driven. The gap between the rolls could be varied from 1/2 to 2 in. The effect on clay of being rolled, the comparison of properties of extruded and rolled columns of the same dimensions, and durability trials are described. It is felt that unreinforced structural clay beams and perforated bricks could be produced by rolling. The rolls can be fed by clay ingots prepared in various ways. Preparation is by cutting from larger masses, whether natural deposits or artificially produced by, for example, sedimentation, casting on a porous bed, filter

pressing, or by agglomerating smaller masses or particles by, for example, impact, vibration, pressing, moulding. This means of producing bricks without the gross laminations formed by the auger in an orthodox machine needs further experimentation. 10fig 1tab (BCA) Abstr. No. 919/63

204

Hofmann, U., E. Scharrer, and W. Czerch, et al.

The Fundamentals of Dry Pressing and the Causes of Space Filling in the Dry Body

Ber. Dtsch. Keram. Ges. 39, 125

In German. In the moist state, clay crystals are held together by the exchangeable cations to form frame works, the gaps in which are filled with water. The strength of such frameworks increases in the order: monovalent, divalent, trivalent ions. The stronger the framework, the lower the drying shrinkage and dry transverse strength. The particularly high dry strength if H_3O^+ and K(plus) ions are present suggests that the cations have a characteristically strengthening effect in the dry state also, due to their bonding to the surfaces of the contacting crystals. 6fig 3tab (BCA) Abstr. No. 2098/62

205

Hughan, R.R.

Lubricant Aids in the Manufacture of Silica and Magnesia Refractories

Refract. J. 38(85)

The effect on dry-pressing of paraffin, kerosene, Diesel oil, glycerol, fatty acids, and their esters, sulphated compounds, and various surface-active agents was studied. Porosity of pressed blocks was taken as a measure of lubrication. The effect on the porosity of silica bricks was negligible. With magnesite, the addition of oleic acid dissolved in kerosene or fuel oil was definitely beneficial. 14tab (BCA) Abstr. No. 2099/62

206

Johnson, W.J.

1962 Documents

Evaluation of NCPRC Research Auger in Sewer-Pipe Production

Am. Ceram. Soc. Bull. 41(9), 550

Tests showed that this auger produces pipes of good quality. 1fig 3tab (BCA) Abstr. No. 248/63

207

Lindl, P.

Interrelations of Properties of Steam-Treated Clay

Ziegelindustrie 15(9), 663

In German. Tests with an experimental steam-treating plant indicate that steam treatment increases the plasticity by "opening-out" the material (without destroying individual clay particles) and by the intrinsic effect of steam and heat. It is considered that hot preparation will become more widely used since it shortens manufacturing time and enables products of higher quality to be made. 19fig (BCA) Abstr. No. 1718/63

208

Lund, H.H., S.A. Bortz, and A.J. Reed

Auger Design for Clay Extrusion

Am. Ceram. Soc. Bull. 41(9), 554

Operating characteristics of augers with varying design parameters were studied. Phase 1 of the investigation is concerned with evaluation of a series of constant-pitch experimental augers, varying in displacement volume per revolution. Designs were based on commercial auger specifications. Performance factors were determined under varying clay and operating conditions. Phase 2 was an evaluation of variable volume displacement augers. An experimental auger series was designed with varying compression ratios and interchangeable propeller segments, based on commercial specifications. Phase 3, the pilot-plant evaluation, determined the validity of the experimental results on extrapolation to full-scale operation. This study established the optimum design characteristics of a clay extrusion auger. 4fig 9tab (BCA) Abstr. No. 249/63

209

Madel, R.

Experience of the European Brick and Tile Industry on the Hot-Preparation of Ceramic Bodies

Ziegelindustrie 15(18), 625

In German. It is argued that with small capital outlay more and better products can be produced. The advantages are: (1) less drying-contraction and thus fewer rejects and greater green strength, (2) the lower surface tension and lower viscosity of the warm water increase capillary diffusion, (3) heat and moisture both flow outwards, (4) drying is at a higher initial temperature, and drying-time is reduced (by 30-70%), (5) power consumption is reduced by 20-25% in spite of the increased output, (6) the properties of the clays are improved with partial elimination of lamination, (7) high mechanical strength of raw and finished products. 2fig 8tab (BCA) Abstr. No. 922/63

210

Moffitt, R.B.

Extrudable Mixes Using Rock Reduce Shrinkage

Brick Clay Rec. 140(2), 54

Describes trials carried out to determine whether certain rocks of "high" and "low" P.C.E. could be used to reduce the total shrinkage of 2 clays, one with a high and one with a low P.C.E. Bars composed of clay-rock mixtures were extruded, 1 in. cross-section and 5 in. long, containing 0, 10, 20, 30, 40, and 50% by volume of the rocks chosen as grog. The bars were dried and fired. Crushed rock of low P.C.E. can be used to reduce the total shrinkage in structural clayware made from clay of relatively high P.C.E. Generally the more fines in the crushed rock the less effective it becomes per unit volume added. 3fig 2tab (BCA) Abstr. No. 2096/62

211

Moore, F.

The Physics of Extrusion

1962 Documents

Claycraft 36(2), 50

Work at the British Ceramic Research Association on aspects of the texture of clay relevant to the extrusion process is reviewed. The relationship between the particle-size distribution and the laminating tendency of a clay is considered, and experiments on the durability in the sodium sulphate test of specimens made from graded materials are reported. The development of anomalous surface properties by polishing and the mechanism for the formation of slip-lines during shear are discussed in detail. An experimental method for the detection of preferential orientation of the clay particles is described, and a mechanism is suggested whereby orientation patterns developed during extrusion may lead to internal stresses after drying and firing. The laminating zones in an extruded column are shown to correspond with maxima in the air-content values of the clay. The paper concludes with a brief mention of two methods of assessing plasticity, a compression test and a cyclic torsion test. 12fig 3tab (BCA) Abstr. No. 920/63

212

Pels Leusden, C.O.

The Plastic Properties of Clay and Their Effect on Some Features of Die Design

Trans. 8th Int. Ceram. Congr., 1962, p. 283

In German. Investigations on coarse ceramic materials with the Williams parallel-plate plastometer lead to the most important laws of flow of plastic bodies, and to the quantitative characterization of clays from a technological point of view, especially in relation to extrusion technique. The processes occurring in the "external" friction of clay on steel are contrasted with the laws of its "internal" deformation. For this measurement clay is forced through cylindrical tubes of different lengths and diameters. Both methods of measurement characterize the flow behaviour of clays and give the relevant physical constants. The "resistance against flow," (C), characterizes the resistances to the "internal" deformation, and the frictional shear stress, ($\tau(R)$), those to the "external" friction. Both laws have a decisive

bearing on die design. In combination with a specially developed and relatively simple testing technique, they have led to the first rules for calculating the processes of flow in the die and mouthpiece and their dependence on the specific properties of the material. The relationships are further elucidated on the basis of the test data, and their consequences for the design and correction of dies to provide relatively strain-free columns are set out. It emerges that the lading or lagging of certain parts of the section of, for example, lattice-perforated bricks is due primarily not to deformation of the clay but to friction against the surfaces of the die. 3fig (BCA) Abstr. No. 2343/62

213

Pels Leusden, C.O.

The Plastic Properties of Clays and Their Influence on the Design of the Mouth-Pieces

Ber. Dtsch. Keram. Ges. 39(8), 427

In German. Plasticity was measured, and the main relationships governing flow in the spacer and mouth-piece were established. Stresses in the clay column, if due to deformation in the mouth-piece, are mainly caused by friction and not by deformation. Therefore mouth-pieces can be corrected by changing the frictional resistance. The most important relationships connected with the friction in cylindrical and conical mouth-pieces have been studied by measurements and have, as far as possible, been treated mathematically so that mouth-pieces need no longer be corrected intuitively. 6fig (BCA) Abstr. No. 683/63

214

Polyakov, M.A.

A New Model of a Vacuum Extruder

Ogneupory 27(8), 364

In Russian. (Abstract not available.) 3pp 1fig (BCA) Abstr. No. 1719/63

215

Robinson, G.C.

1962 Documents**How to Make Clay Block on Concrete Block Machines**

Brick Clay Rec. 140(1), 66

Describes the type of clay to use, the preparation of binder material, chemical additives, types of aggregate, and laboratory tests used to predict performance on a block machine. 7fig 5tab (BCA)
Abstr. No. 2097/62

216

Sladkov, A.S.

De-Ironing Glass Sands in a Mill with an Abrasive Action

Glass Ceram. (Engl. Transl.) 19(4), 194

(Abstract not available.) 5pp 2fig 2tab (BCA)
Abstr. No. 917/63

1963 Documents

217

Making Lightweight Aggregate with Brickmaking Facilities

Brick Clay Rec. 143(5), 48

An aggregate plant uses brick extrusion equipment to make pellets for the rotary kiln process. The extruder handles clays with 12-16% moisture content. The extruder pelletiser produces clay pellets $1/2 \times 1/2 \times 3/4$ in., which are dried in a rotary dryer using the exhaust gases of the rotary kiln. The kiln output is 240 t/day. Preheated to 1950 degrees F, the material is discharged into the bloating-kiln (2100 degrees F) through an enclosed refractory slide. Pilot trials plus concrete cylinder tests indicated that a coated aggregate of 45 lb/ft³ was best. 3fig (BCA) Abstr. No. 1017/64

218

Bass-Walker, P.

Steam Treatment of Clay and Its Effects on Drying

Claycraft 36(5), 173

The Handle system of steam-heating clays. One plant has been operating in Wales on this system for over two years, and five brickworks in England are due to receive steam-heating systems. Before such equipment is installed, it is recommended that the clays to be worked should be examined thoroughly to decide the most suitable type of steam. The equipment is controlled by magnetic and motor valves. 3fig (BCA) Abstr. No. 1716/63

219

Bedeschi, G.

Steamless Hot Extrusion of Brick Clays

Claycraft 37(3), 88

The process, developed in Italy, is based on the principle of heating a mix which already has the correct minimum percentage of moisture required for extrusion, exchanging heat between it and a heating fluid, and ensuring that they are not in direct contact. The plant consists of a furnace which is surrounded by an air space through

which secondary mixed air is introduced together with the products of combustion. The heat exchanger consists of a group of parallel pipes 10 mm apart and forming an ellipse, and they are welded at the end to two drilled flanges. The exchanger is held by the flanges to the upper mixer of the extruder on one side, and to the de-airing chamber in the other. The clay is pushed, under pressure by the two shafts of the mixer, through the pipes into the de-airing chamber. The hot gases from the furnace, travelling in counterflow to the clay, impinge on the external surface of the pipes, heating the clay pushing through them. 3fig (BCA) Abstr. No. 953/64

220

Belonogov, M.V.

Forming Blanks (Slugs) for Electrical Insulators

Glass Ceram. (Engl. Transl.) 20(11), 605

The process of extrusion is examined theoretically. The influence of the taper of the mouthpiece and the water content of the body is considered. 4pp 6fig (BCA) Abstr. No. 1612/65

221

Bertoldi, G.

The Behaviour of De-Aired and Unde-Aired Clays for the Heavy-Clay Products

Ziegelindustrie 16(4), 123

In German. Description of lab experiments: Water absorptions are compared (boiling in water for 3 hours) of de-aired and unde-aired clays after firing at various temperatures. With some materials the water absorption was 10-15% lower after de-airing. The transverse strength of de-aired clays after firing at 100 degrees C is increased by 10%. 4fig (BCA) Abstr. No. 1720/63

222

Capriz, G.

A Theoretical Analysis of Extrusion Processes

Trans. Br. Ceram. Soc. 62(4), 339

1963 Documents

For a theoretical study of the behaviour of a clay during extrusion, a model must be introduced to describe the mechanical properties of the clay. The simplest model is the Bingham body--a body characterized by two material constants: a yield stress and a viscosity. Some types of flow of a Bingham body (such as the flow in a tube or between co-axial cylinders and the flow in a conical channel) have been studied already, but the final formulae resulting from these studies are rather complicated, so that further developments and particularly applications to problems of technical interest are awkward. To overcome the difficulty a simplifying condition is introduced, which does not seem to be too onerous in practice: to consider only flows so slow that the viscous stresses which arise are on average much smaller than the yield stress. The hypothesis is expressed rigorously, its consequences in the study of some typical problems are shown, and the formulae arrived at are used for the approximate study of ram extrusion. Existing analyses of the motion of a Bingham body in an auger rely on the simplifying hypothesis that the auger channel is shallow. In practice this condition is not satisfied. A more adequate model has therefore been introduced in which no condition is put on the aspect of the channel, although the local effect of the side walls is still disregarded. It is then possible, for instance, to follow the transition between pug flow and viscous flow. 6fig (BCA) Abstr. No. 2386/63

223

Entelis, F.S., and A.I. Smirnova

Investigating the Processes of Plastic Forming

Glass Ceram. (Engl. Transl.) 20(10), 529

Concerns the plastic shaping of flatware and the warpage that can occur during drying and firing. Batting out occurs in two stages: During (1) only the top layers of the clay move, the bottom part remaining undisturbed. During (2) the whole bat increases in diameter. This behavior is examined mathematically, and the implications relative to machine design are considered. 7pp 11fig (BCA) Abstr. No. 1610/65

224

Gaidash, B.I.

Continuous Forming of Screw-Ribbed Insulators

Glass Ceram. (Engl. Transl.) 20(11), 609

The sheds are in the form of a continuous helix. An extruder is described that produces a clay column having such a helix. 3pp 4fig (BCA) Abstr. No. 1613/65

225

Levitskii, G.D.

Mathematical Analysis of the Operation of Vacuum Pugmill Auger Blades

Glass Ceram. (Engl. Transl.) 20(8), 434

This analysis shows the distribution of the peripheral forces and turning moments at the surface of the auger, and also the distribution of shear strains due to friction of the blades on the body, which permits a more rational design for the extruder blade of the auger. An equation makes it possible to determine the diameter of the hub in relation to the coefficient of friction on the body on the blade of the auger. Another equation permits one to establish the angle of rise of the screw line of the auger's hub in relation to the magnitude of the coefficient of friction of the body on the blade. Knowing the angle of rise of the screw line it is possible to determine the design of the auger. 10pp 8fig (BCA) Abstr. No. 949/65

226

Mitsubishi Genshiryoku Kogyo Kambushikikaisha

Process for Extruding Ceramics under Vacuum

Patent No. French FR 1,382,118, 24 Jul, 1963,

In French. The body is extruded into a de-airing chamber, then fed directly into a piston-type extruder. (BCA) Abstr. No. 43/66

227

Mohler, N.F.

Control of Columns

1963 Documents

Ziegelindustrie 16(22), 830

The control system for measuring consistency and for the motor load system is briefly described and illustrated. The effect of calcined material in the manufacture of bricks and structural tile is discussed, and the advantages of calcine over grog are reported. 2fig (BCA) Abstr. No. 954/64

228

Reveley, A.

Methyl Cellulose in Ceramics and Refractories

Refract. J. 39(9), 372

The main properties of methyl cellulose used in the production of refractories and electroceramics are briefly noted: low ash-content water retentivity, low surface-tension, strong film formation, thermogelation, and rheology. "Celacol" grades having viscosities in 2% aqueous solution of 2,500, 5,000 and 10,000 cp may be used, and the rate of addition of a 2% solution is normally lower than for an ordinary water addition. When maximum binding power is required, as in certain electro-ceramics, low viscosity grades are used in concentrations of 6-10%. (BCA) Abstr. No. 467/64

229

Ries, H.B.

Trends in the Development of Preparation Technology in the Heavy-Clay Industry

Keram. Z. 15(1), 18

In German. Three main trends are defined: automation of individual processes, changeover to fine grinding, and conversion from volumetric to gravimetric proportioning. Numerous machines and layouts are briefly described and illustrated. 19fig 2tab (BCA) Abstr. No. 1717/63

230

Seanor, J.G.

Laminations--What Causes Them in Clay Performance. IV.

Brick Clay Rec. 143(1), 38

The tendencies of clays to laminate as a result of the feed and speed of rotation of augers, the effects of internal lubricants in the pugging water, and the relationships of particle size to laminations. 3fig (BCA) Abstr. No. 30/64

231

Seanor, J.G.

Laminations--What Causes Them in Clay. III.

Brick Clay Rec. 142(6), 64

The deformability of clays without creating shear is discussed: also augers, dies, spacer rings, and their effect on laminations. 4fig (BCA) Abstr. No. 2388/63

232

Thompson, J.J.

Forming Thin Ceramics

Am. Ceram. Soc. Bull. 42(9), 480

The first method is an extrusion process in which a plasticized water-soluble organic binder is used. The second method is the "knife coating" of a highly viscous slip onto an impervious carrier film. An example of a binder system is given for each process, with supplementary information on potential binders. 1fig (BCA) Abstr. No. 466/64

233

White, J.F., and A.L. Clavel

Extrusion Properties of Non-Clay Oxides

Am. Ceram. Soc. Bull. 42(11), 698

Plastic dispersion masses of non-clay oxides were prepared with organic plasticizers, and the flow characteristics were measured by an extrusion method. For a given powder they depend on the kind and amount of organic plasticizer used and, for a given plasticizer, on the kind, amount, and grain-size of the oxide powder. Some non-clay powders can therefore be prepared with flow characteristics similar to those of a plastic clay. Under certain conditions, with a minimum amount of organic plasticizer, the resulting mass behaves as a Bingham solid if the pressure neces-

1963 Documents

sary for flow is applied rapidly, but as a dilatant mass if the pressure is applied slowly. A model was prepared for the non-clay oxide plastic dispersion mass, based on the concept of the adherence of organic matter to oxide particles, and is used in the discussion of results to explain

changes in flow characteristics. The concept of film thickness and the character of the outermost "layers" are used to describe the causes for such behaviour as thixotropy. 6fig 2tab (BCA) Abstr. No. 949/64

1964 Documents

234

The Water-Content Equilibrium of Clays
Sprechsaal 97(5), 104

In German. Clays which had been dried at different temperatures and relative humidities were studied. The influences of drying-temperature, pre-treatment, and addition of NaCl to the clay were ascertained. The expansion of a clay on the absorption of moisture was measured, and the effects of NaCl addition, specimen shape, and drying-treatment were investigated. 5pp 5fig 4tab (BCA) Abstr. No. 1954/64

235

Alviset, L., and G. Arle
Hot Extrusion

Trans. 9th Int. Ceram. Congr., 1964, p. 539

The choice of temperature, steam pressure and degree of vacuum for hot extrusion is considered on the basis of laboratory tests. 14pp 11fig 3tab (BCA) Abstr. No. 947/65

236

Bedeschi, G.

The Warming of Clay for Hot Extrusion Without the Introduction of Steam

Ind. Ital. Laterizi 18(4), 175

In Italian. A design for heating the spacer of a pug externally. The clay can be heated to 90 degrees. It is claimed that this procedure is advantageous when the clay already contains sufficient water. 6pp 5fig (BCA) Abstr. No. 1608/65

237

Belonogov, M.V.

Forming Lamination-Free Blanks for Electric Insulators

Glass Ceram. (Engl. Transl.) 21(8), 465

A theoretical examination of the causes of lamination during extrusion. 4pp 6fig (BCA) Abstr. No. 379/66

238

Hubner, F.

A New Unit for the Homogeneous Distribution of Steam for the Rapid Drying of Ceramic Ware

Ziegelindustrie 17(20), 749

In German. A patented device admits superheated steam uniformly to clay that is to be extruded. It is in the form of a fixed wheel with radii pierced with holes. 4pp 6fig (BCA) Abstr. No. 1609/65

239

Iberg, R.

Influence of Steam Extrusion on the Quality of Burnt Products--Aspects and Experiences

Claycraft 37(5), 168

Tuileries Zurichoises, Switzerland, desired to produce a brick, without cracks, of 400 kg/cm² minimum crushing-strength, and 20 g/dm² maximum water absorption (3000 J 18; 25 x 18 x 13.5 cm). Maximum pressure of the steam addition was 1.6 and 3.6 atm, according to the required temperature of the mix. Raw material worked contained 40% clay, primarily illite, with traces of montmorillonite. Bricks were Keller-dried and fired in a zig-zag kiln. The best moisture content for extrusion was found to be 21-22%. Variations of plus or minus 2% in the proportion of clay in the raw material and the degree of moisture in and regularity of delivery of the raw material to the press strongly affected drying and firing. Excellent results were obtained at column temperatures from 65-70 degrees. It is concluded that the steam treatment has advantages. 5pp 3tab 13fig (BCA) Abstr. No. 1452/64

240

Levitskii, G.D.

Investigating the Extruding Power of an Auger Mechanism

Glass Ceram. (Engl. Transl.) 21(10), 589

A mathematical treatment of the problem. 8pp 6fig (BCA) Abstr. No. 381/66

1964 Documents

241

Lund, H.H., and M.B. Levine

Improvements in or Relating to the Measurement of Consistency

Patent No. Brit. GB 951,848, 11 Mar, 1964,

The clay is mixed in a pug-mill and passed through a vacuum chamber to remove air before being fed to a product-forming portion of the system. A feeler system is included in the path of the material flow, such as at a point at the entrance to the vacuum chamber, and pressure on this feeler provides an indication of the consistency of the clay, etc. The force exerted on the feeler may be converted into an electrical quantity and this used to measure or control, etc., the mixing of the material to give the required degree of consistency to the material. 8pp 7fig (BCA) Abstr. No. 2239/64

242

Pels Leusden, C.O.

The Rheological Properties of Plastic Bodies in the Heads of Augers

Trans. 9th Int. Ceram. Congr., 1964, p. 553

In German. The flow of clay in the spaces of an auger was studied by a marking system which permitted observation of the uniformity of flow of the clay column. The effect of the taper in the spaces is discussed. 13pp 14fig (BCA) Abstr. No. 948/65

243

Richez, R.

A New Method for the Study of Lamination Phenomena

Trans. 9th Int. Ceram. Congr., 1964, p. 227

In French. The effect of lamination on transverse strength was examined. Frost tests were also used to reveal lamination. 10pp 6fig 3tab (BCA) Abstr. No. 946/65

244

Shchepilov, N.S., and Z.M. Shchedrinskaya

New Cross-Piece Design for Mouthpiece Used to Shape Ceramic Pipes

Glass Ceram. (Engl. Transl.) 21(4), 201

After studying the causes of cracking and trying a crosspiece with different rib arrangements, the authors developed and tested a design for the crosspiece with the optimum angle of inclination of rib. The best results were obtained with a minimum distance between rib and support blade. During use at the Artemov Ceramic Pipe Plant of the crosspiece with inclined ribs, longitudinal lamination of the shaped pipes of different diameters was not experienced. 2pp 6fig (BCA) Abstr. No. 2434/65

245

Shchepilov, N.S., Z.M. Shchedrinskaya, and V.S. Leonenok

Eliminating Ring Cracks in the Production of Ceramic Pipes

Glass Ceram. (Engl. Transl.) 21(6), 336

The cracks in question are formed by the development of slip-planes between the moving clay in the cylindrical part of the socket and the static part of the body between the plate and the core. Practical methods are given for preventing these cracks. 4pp 8fig (BCA) Abstr. No. 380/66

246

Shiraki, Y., N. Otsuka, and K. Ogawa

Studies on the Orientation of Clay Particles. II. Studies on Texture in Suspension-Insulator Green Body

J. Ceram. Soc. Jpn. 72(9), 143

In Japanese. Deals with differences in texture. The dried body was cut along different directions to obtain test-pieces for measuring the particle size distribution, d.t.a., imbibitional swelling in water, thermal expansion and porosity, and also the thermal expansion of fired specimens. With plastic forming not only was the orientation of clay particles different, but non-plastic grains were concentrated in the interior of a body, associated with flow-phenomena of a plastic mass. 7pp 12fig 5tab (BCA) Abstr. No. 1614/65

1964 Documents

247

Teilps, B.

**Satisfactory Brickmaking as a Result of
Steam Preparation**

Ziegelindustrie 17(24), 893

In German. Experience at 18 German brickworks has shown that most of the faults that arise during extrusion and drying can be eliminated by steam preparation. The economics achieved are stated in terms of percentages. Types of hot preparation machines are described. 4pp 6fig (BCA) Abstr. No. 2030/65

1965 Documents

248

Hot Preparation and Hot Forming

Br. Clayworker 74(875), 110

The injection of steam for preparation and for shaping is discussed. Preferably the steam generator should be incorporated in the machine. Costs are quoted on the basis of experience at two British brickworks. 3pp 5fig (BCA) Abstr. No. 22/66

249

Hot Preparation and Hot Forming. I.

Br. Clayworker 74(874), 74

The steam preparation of clay is considered to be as big an advance as was de-airing. Nearly all of the firms that have used this process have reported success. The normal steam pressure is 60-90 lb/in.². 3pp 3fig (BCA) Abstr. No. 2689/65

250

Alviset, L., and G. Arle

Hot Extrusion

Ziegelindustrie 18(6), 187

In German and French. Experiments showed that only those clays that can be extruded cold can be extruded hot. The extrusion temperature depends on the drying properties and on the moisture content. Before steam is added the clay must have a moisture content 4% less than that required for extrusion. De-airing is important, although the degree of vacuum is less than in cold extrusion. The "immediate shrinkage" of the products on leaving the extruder is the result of surface drying. Quicker drying is due to higher temperatures being used in the early stages so that the rate of water expulsion is increased. The order in which clays can be graded according to their drying-properties is the same for both hot and cold extrusion. With some clays of medium or poor drying-properties, hot extrusion followed by rapid drying appeared to lead to some decrease of mechanical strength. Since the main limitation of hot extrusion is the initial moisture content, clays are being pre-dried in a rotary dryer and heated without adding steam. The merits of hot extrusion are regarded as equal to

those of de-airing. 12pp 10fig 3tab (BCA) Abstr. No. 2688/65

251

Astbury, N.F., and F. Moore

Torsional Hysteresis in Plastic Clay

Stewart, G.H.(ed.), Science of Ceramics, Proc. 2nd Conf., Brit. Ceram. Soc., 13-17 May, 1963. New York and London: Academic Press, p. 147

An account is given of some experimental studies on the behaviour of plastic clay under symmetrical cyclic torsional strain. Characteristic hysteresis is observed, and a model is proposed to explain the behaviour. The limitations of the model are discussed in terms of the observed results, and the relevance of the work to the concept of technical plasticity is briefly noted. 12pp 4fig 6tab (BCA) Abstr. No. 2029/65

252

Capriz, G., and A. Laratta

Extrusion of Non-Newtonian Bodies

Proc. Br. Ceram. Soc. (3), 117

Bodies are considered which under simple shear stress move with a strain rate proportional to a power of the shear stress. A study is made of the relationship of the bodies in question to more general continua, and of the properties which they exhibit under simple conditions. Results are presented regarding the pressure flow in a conical die. The behaviour during ram or screw extrusion is also discussed. 17pp 8fig (BCA) Abstr. No. 708/66

253

Clavel, A.L., J.C. Blake, and J.F. White

Measurement of Flow Characteristics of a Plastic Dispersion Mass

Am. Ceram. Soc. Bull. 44(9), 669

A device that provides a graph relating extrusion rate to applied pressure. Results are shown for plasticized BeO. 3pp 4fig (BCA) Abstr. No. 1488/66

1965 Documents

254

Haring, J.

Augers

Ziegelindustrie 18(10), 373

In German. For satisfactory operation the surfaces of the knives should be polished whereas the inside of the barrel should be rough. 2pp (BCA) Abstr. No. 25/66

255

Heil, A.C.

The Vacuum Extrusion Machine in the Fine China Industry

Silik. J. 4(6/7), 140

In German. Filter-cakes are taken straight from the filter press to the extruder, which homogenizes and de-airs the body. Photomicrographs show the difference between the texture of electrical insulators made from clay that has been pugged only and those extruded under vacuum. 2pp 4fig (BCA) Abstr. No. 959/66

256

Herdt, K., and A. Bergholz

The Effect of Temperature on the Shrinkage of Ceramic Bodies and Clays During Drying

Silikattechnik 16(2), 375

The general course of drying of ceramic products is discussed. 5pp 11fig (BCA) Abstr. No. 1886/66

257

Kampf, L.

Device for Suppressing Lamination During Extrusion

Silikattechnik 16(11), 351

In German. A multiple rotating intermediate barrel between the end of the auger and the mouthpiece. This design still appears to be at the drawing-board stage. 4pp 7fig (BCA) Abstr. No. 1866/66

258

Pickus, M.R., and M. Wells

A Technique for Extrusion Forming of Brittle and Refractory Compositions

Powder Metall. 8(16), 351

Recently, a number of compounds of transition-group metals with C, N, B, and Si have been found to exhibit high values of the important superconducting parameters, critical temperature and critical magnetic field strength. As a group, these compounds are characterized by high melting points and extreme brittleness, and hence require special fabricating techniques. A brief description is given of an extrusion method. A powdered material, either metallic or not, is coated with polystyrene in such a manner and proportion that the mixture as a whole takes on the characteristics of a typical thermoplastic. The preparation may then be subjected to the forming methods commonly employed with plastics, such as moulding, extruding, and hot forming. Brittle materials may thus be obtained in the form of rod, ribbon, or wire. These products are next subjected to a programmed heating cycle in an appropriate atmosphere, during the course of which the polystyrene is volatilized and sintering of the powdered material takes place with retention of the original shape. Under favorable conditions, sintering may proceed to a point where near-theoretical densities are attained. Among the materials processed by this methods are the carbides Ta and Nb, carbo-nitrides of Nb, WC/Co mixtures, and Al_2O_3 . 13pp 6fig (BCA) Abstr. No. 1867/66

259

Schuster, A.

Suggestions and Results in the Shaping of Ceramic Mixes by Extrusion

Keram. Z. 17(2), 88

In German. Mixes of low plasticity are preferably worked with a vacuum. Otherwise, de-airing is much less important than uniform mixing and moistening of the material. This can hardly be achieved in the heavy-clay industry with continuous operation. The author therefore recommends intermittent weighing of the batch with subsequent intermittent intensive mixing.

1965 Documents

Examples from practice show that this method enables many faults which arise with continuous operation to be eliminated. 2pp 2fig (BCA) Abstr. No. 2433/65

260

Spiegler, A.

Control of the Operation of an Extruder for Bricks

Ziegelindustrie 18(18), 625

In German. Equipment for recording the performance of an extruder includes an output recorder and an ammeter. It is claimed that with this equipment it is possible to determine whether any irregularities in the clay column originate in the clay or in the operation of the machine. 4 pp 1tab (BCA) Abstr. No. 1240/66

261

Thomas, H.A.

Laminations Eliminated by Vanes Welded to Auger

Brick Clay Rec. 146(6), 56

Steps taken to reduce breakage and lamination resulting from the extrusion of bricks were: (1) a machined and polished insert was introduced inside the barrel extension; (2) pyramidal vanes were welded on, and near the end of, the auger shaft. 3pp 6fig 2tab (BCA) Abstr. No. 709/66

262

TNO Central Laboratory

The Moisture Content Equilibrium of Clays

Ziegelindustrie 18(24), 865

In German. A moulded clay product will attain equilibrium with a certain moisture content corresponding to each temperature and hygrometric state of the air. Knowledge of this state at various temperatures and relative humidities indicates whether the raw piece will take up or yield water under known conditions. The moisture equilibrium of pieces of clay, their grain-size (which has no effect) and temperature (equilibrium depends on the nature of the clay and R.H. of the air but not on the temperature) were measured. The addition of NaCl had a slight influence. A major cause of cracking is too low a residual moisture content. 5pp 5fig 4tab (BCA) Abstr. No. 1885/66

263

Williamson, W.O.

Causes and Consequences of Clay Particle Orientation in Ceramic Fabrication Processes

Lawrence, W.G.(ed.), Clay-Water Systems. New York, NY: Alfred University, 1965, p. 148

(Abstract not available.) 26pp 7fig 1tab (BCA) Abstr. No. 1832/66

1966 Documents

264

Alviset, L., and G. Arle

Laboratory Tests on Steam Extrusion. I.

Claycraft 38(7), 250

The tests were carried out with a micro-vacuum extrusion machine with four steam-injector nozzles fitted in the mixer feed box. The steam was provided by an electric generator capable of producing saturated steam up to a pressure of 8 kg/cm². The influence of the initial moisture contents, the degree of vacuum and the temperature were studied. 5pp 2fig 6tab (BCA) Abstr. No. 24/66

265

Ball, A.J.

The Economic Advantages of Steam Tempering

Claycraft 38(8), 298

Examples are given for hot and for cold extrusion. 3pp (BCA) Abstr. No. 23/66

266

Bass-Walker, P.

Clay Preparation and Extrusion. I.

Claycraft 39(7), 241

The best method of preparation depends on the type of clay. Shales and hard marls which take up very little water until crushed are best prepared dry, using crushing-rolls, dry pans, impact brakers or ball mills. Clays free from stones and soft shales are best prepared by a semi-stiff method, e.g., in roller mills. Clays and loams that easily disintegrate and absorb water quickly are prepared wet. Machines are described. 4pp 4fig (BCA) Abstr. No. 26/67

267

Belopol'skii, M.S., and N.N. Fantalov

Conveyor for Moulding, Drying and Glazing Pipes

Glass Ceram. (Engl. Transl.) 23(3), 138

A transfer system for use in the downward extrusion of pipes and the dryer for use in pipe-making

are described. Heat consumption of the latter is less than or equal to 1500 kcal/kg of water evaporated. 3pp 3fig 1tab (BCA) Abstr. No. 1786/67

268

Beyer, B.

A New High-Efficiency Vacuum Extrusion Press

Interceram (2), 171

Two extruders are placed one above the other, joined by the vacuum chamber. A new type of feeding system with a smooth drawing-in roller and waisted drawing-in screw ensures a large absorption capacity. Speed control for the two extruders is independent, and high driving-power allows bodies of reduced plasticity to be worked. Two cutting sizes treat 4-5 t/h and 10-14 t/h, respectively, of a body with 20-27% humidity. Power required is 20 or 55 kW. The dimensions are 10 ft 6 in. x 8 ft x 4 ft and 12 ft x 14 ft 6 in. x 5 ft 6 in. The extruder is readily adapted to automatic production. 2pp 2fig (BCA) Abstr. No. 2320/67

269

Bruckner, E.

New Ideas on the Shaping of Porcelain Bodies

Keram. Z. 18(12), 866

In German. A vacuum extruder in which the shaft can oscillate, which reduces the viscosity of the body and eliminates lamination. The roller making machine is claimed to shape ware without the introduction of stresses. 3pp 11fig (BCA) Abstr. No. 1484/67

270

Butterworth, B., L.W. Baldsin, and S.G. Coley

Dies for Extruding Perforated Bricks

J. Br. Ceram. Soc. 3(4), 563

A detailed description of the dies developed at the Building Research Station, England, for the extrusion of hollow-blocks for complicated design. 21pp 20fig (BCA) Abstr. No. 1486/67

1966 Documents

271

Conner, J.H.

Mechanization of Pugging Processes

Am. Ceram. Soc. Bull. 45(2), 183

Procedures and equipment were combined to mechanize pugging in the extrusion of red-shale bricks. Pugging was modified and simplified so that a pug-mill attendant is not required. Addition of water and monitoring of the pugged mix mechanically provides an improved and more consistent pugged mix. Maintenance of equipment components has not been a serious problem. 4pp 7fig (BCA) Abstr. No. 2442/66

272

Hall, W.B.

Deflocculants in the Extrusion of Clays

Am. Ceram. Soc. Bull. 45(2), 211

The effect of adding 0.05% Na silicate was examined. 1p 2tab (BCA) Abstr. No. 2443/66

273

Klein, L., and D.I. Marshall

Mathematical Models of Extrusion

Ind. Eng. Chem. 58(10), 36

Refers to the extrusion of plastics. 4pp 3fig 5tab (BCA) Abstr. No. 1077/67

274

Kuhn, R.

A Double-Exit Mouthpiece for Bricks with Thin Walls

Ziegelindustrie 19(1), 4

In German. The clay column is equally divided by a metal wedge set behind the double mouthpiece. The relationship between the forces of inertia and friction is examined, and instructions are given to ensure steady movement of the column and uniform pressure distribution. This double mouthpiece is claimed to increase output by 66%. 2pp 2fig (BCA) Abstr. No. 2441/66

275

Leimer, H.

The Automatic Production of Sewer-Pipes

Keram. Z. 18(10), 733

The pipes are 100-500 mm diam and 1-2 m long. Extrusion and the production of the socket are entirely automatic, but few details are given. 4pp 4fig (BCA) Abstr. No. 1078/67

276

Otremba, R.R.

Extruded Xerogel Catalysts Containing Magnesia Particles

Patent No. U.S. US 3265793, 9 Aug, 1966, 4 pp. USA

Solid mixtures of SiO_2 -MgO and Si_2 - Al_2O_3 -MgO become easily extrudable when U.S.P. grade MgO is used instead of technical grade MgO. The former has a much higher surface area (greater than $100 \text{ m}^2/\text{g}$) and pore volume (greater than 0.20 cc/g) than the latter. U.S.P. grade MgO 5-35 weight % (dry basis) was used in the preparation of the xerogel, Water 35-55 weight % based on the wet mass gave the best plasticity during the extrusion process to yield rods, pellets, or the like for use as catalysts. (CAS) Abstr. No. CA66(2):6061e

277

Pels Leusden, C.O.

The Design of Mouth-Pieces for the Manufacture of Curved Pipes

Ber. Dtsch. Keram. Ges. 43(10), 640

In German. Curved pipes can be extruded by means of an eccentric shaft or by altering the depth of the mouthpiece. Calculations are demonstrated for two clays, and the results are discussed. Only the use of a modified mouthpiece gives satisfactory curved pipe. 2pp 1tab (BCA) Abstr. No. 1079/67

278

Pels Leusden, C.O.

Flow in the Extruder

Ziegelindustrie 19(16), 613

1966 Documents

In German. Pressure-measuring devices were installed at various points along the screw of an extruder, and the pressure was measured as a function of length of screw, output, speed of rotation and moisture content. The effect of power consumption on the quality of the clay column was also examined. The output of a clay extruder is usually only 18-24% of the theoretical. 10pp 10fig (BCA) Abstr. No. 564/67

279

Pels Leusden, C.O.

Flow Mechanics Within the Pug

Trans. 10th Int. Ceram. Congr., 1966, p. 471

In German. The processes taking place in a pug are discussed, particularly mixing and flow. 14pp 15fig (BCA) Abstr. No. 1785/67

280

Stefan, B.

Rheological Properties and the Forming of Fireclay Batches

Polska Akad. Nauk, Ceramika (5), 71

In Polish. The pressure developed during the extrusion of mixes containing various amounts of water was measured. The rate of extrusion at various moisture contents was also determined. 24pp 6fig 7tab (BCA) Abstr. No. 1485/67

281

Stolze, W., and J. Vesper

A Simple Device for Assessing the Quality of Ceramic Bodies Coming from the Pug

Silikattechnik 17(5), 152

In German. A torsion test was used. The direction in which the sample is taken from the clay column has considerable influence on the result of the test. 3pp 9fig (BCA) Abstr. No. 3253/66

282

Van der Klugt, L.J.A.R.

Extrusion Problems--A Remarkable Phenomenon Shown by Extruded Products: Impairment of Quality Due to Delays Before Drying

Oesterr. Keram. Rundsch. 3(9/10), 167

In German. The defects are due to loss of plasticity obtained by de-airing and the appearance of cracks within the brick, which occur when drying is very slow, and depend on the nature of the clay, the temperature of shaping, the temperature at which the bricks stand before drying, the amount of de-airing, and the consistency of the body during shaping. The defects are attributed to the evolution, during standing, of gas dissolved in the water contained in the brick. It follows that, during shaping, the voids and the temperature should be as high as possible, and the structure might be improved by the addition of brick dust. 5pp 8fig (BCA) Abstr. No. 808/67

283

Williamson, W.O.

Structure and Behaviour of Extruded Clay. I. Surveying Microstructure and Flow Patterns

Ceram. Age 82(2), 39

The lamination of a clay during extrusion was studied. The laminar flow produces superficial layers having special properties, and slip bands occur perpendicular to these layers. Kaolinite and illite or other micas are the most abundant clay minerals in conventional ceramic bodies. Their crystals and cleavage fragments are essentially plate-like, and thus develop planar orientation when extruded. The "peel" method was used to study clay textures. It consists of impregnation of test pieces with suitable organic plastic containing a soluble dye. Colouring is compared after extrusion. Potential laminations may also be revealed by freezing the extruded column. Ice films form and then thicken as water migrates to the growing ice crystals. The resulting expansion accentuates the tendency of the test-pieces to fracture when it is subsequently thawed. Subjection to vacuum may also reveal potential laminations. 2pp 1fig (BCA) Abstr. No. 2444/66

284

Williamson, W.O.

1966 Documents

Structure and Behaviour of Extruded Clay. II. Piston and Auger Extrusion

Ceram. Age 82(3), 27

Thin circular discs were made of fine-grained kaolinite-illite ball clay. When placed face to face these discs formed a cylinder in which the clay platelets were approximately perpendicular to the axis. The cylinder fitted into the 12.5 mm I.D. barrel of an extruder. A piston forced the cylinder through a die via a channel 6.5 mm I.D. and 16 mm long. Expulsion of the clay, which reduced the diameter of the cylinder by about 50%, rearranged some of the platelets parallel to the surface of the extruded column and perpendicular to their original position. A region of minimum deformation occupied the central part of the extruded column. With auger extrusion the structure is more complex because of the action of the screw or knives. A laminar flow-pattern is produced by slowing down of progress along the auger. The clay develops a polish or

thin layer against the surface of the layer. Spiral S shapes can be found in cross-sections of some columns made by piston, not auger, extrusion. The polished layer originally produced at the surface of the auger may be involved in these spirals and provide textural heterogeneities which help to produce laminations. 3pp 5fig (BCA) Abstr. No. 2999/66

285

Williamson, W.O.

Structure and Behaviour of Extruded Clay. III. Effects of Extrusion

Ceram. Age 82(4), 41

A cylinder of extruded clay contains more water in the middle than in the outer layers, thus giving rise to uneven drying shrinkage. The shrinkage is greater perpendicular than parallel to the direction of extrusion; however, with very large extruders this tendency may be reversed. 3pp 1fig (BCA) Abstr. No. 28/67

1967 Documents

286

Donotti, S.

A New High-Output De-Airing Pug for Stiff Extrusion

Keram. Z. 19(3), 151

In German. A new Italian de-airing pug can extrude clay containing 17-20% water at 30 tons/hr. It can produce solid or perforated bricks. 1p 2fig (BCA) Abstr. No. 2241/67

287

Fawcett, J.D.

Some Aspects Concerning American Brick and Pipe Machines

Claycraft 40(4), 134

Short notes on U.S. practice in stockpiling, clay preparation, screening, blending and extrusion. 3pp 8fig (BCA) Abstr. No. 2774/67

288

Maurer, K.

Accelerated Stiffening of Extruded Ceramic Bodies

Silik. J. 6(7/8), 215

In German. Screw and piston extruders were used to make small steatite tubes or disks, porcelain rods 100 mm diam, or stoneware pipes 250 mm diam. Electrodes were inserted in the spacers, and the body in this zone was heated to 80-90 degrees. Soon after its exit from the mouth-piece, the clay column dries out, and the column stiffens. 4pp 6fig (BCA) Abstr. No. 636/68

289

Maurer, K.

The Mechanical Properties of Ceramic Bodies from the Viewpoint of Their Drying Behaviour

Silik. J. 6(7/8), 209

In German. Five porcelain bodies were submitted to tensile, transverse, and shear tests; the transverse test was the most reliable. During drying, these bodies passed through three stages of

stress/strain behaviour: plastic, elastic and Bingham. The danger of cracking was found to depend on the time during which the body was exposed to stress. Rapid drying can sometimes be less damaging than slow drying. 5pp 12fig 1tab (BCA) Abstr. No. 647/68

290

Pels Leusden, C.O.

Mixing and Homogenizing During the Preparation of Plastic Ceramic Bodies

Ziegelindustrie 20(22), 710

In German. The mixing of a plastic body containing 2 or 3 constituents is considered theoretically. Various types of mixer are characterized by formulae. Particular attention is paid to the dispersion of the water that is present. 6pp 11fig (BCA) Abstr. No. 1117/68

291

Pels Leusden, C.O.

Relationships Between the Rheological Properties of Plastic Ceramic Materials and Certain Technical Values During Shaping

Ber. Dtsch. Keram. Ges. 44(10), 506

In German. Starting from a comparison of the characteristics of ideal elastic, viscous, and plastic bodies, the author goes on to investigate the true behavior of plastic bodies, quoting various examples of preparation and shaping. Particular reference is made to the fact that the yield value is a tensor and to the dependence of the yield value on the water content of the body and on the hydrostatic pressure during shaping. 7pp 12fig (BCA) Abstr. No. 1118/68

292

Produits Chimiques Pechiney-St Gobain

Ceramic Material Extrusion

Patent No. Brit. GB 1,064,018, 5 Apr, 1967,

The extrusion of hard abrasive grains is facilitated by adding gibbsite of large active surface area, e.g., greater than 80 m²/g. The method is particularly suitable for preparing extruded

1967 Documents

ceramics comprising Al_2O_3 , e.g., for making catalyst carriers and other refractory objects. In an example, alpha- Al_2O_3 of Blaine area $10,000 \text{ cm}^2/\text{g}$ is ground to particles of a mean grain size $2.5 \mu\text{m}$, grains of less than $5 \mu\text{m}$ forming 99.5% of the total mass. A paste is prepared with 100 g of the Al_2O_3 , 57 g of water and 1.5 of gibbsite having a large active surface area, and is extruded into "sausages" 12 mm diam and of unfired density $1.9/\text{cm}^3$. The density becomes $3.8 \text{ g}/\text{cm}^3$ after firing at 1600 degrees C for 1 hour, and $3.85 \text{ g}/\text{cm}^3$ after firing at 1650 degrees C for 1 hour, the extrusions being of smooth appearance. (BCA) Abstr. No. 2463/67

293

Radford, C., L.K. Austin, and J. Collier

The Effect of Flocculants on the Plasticity of Bone China

Ceramics (London) 18(219), 23

The effects of $\text{Al}[\text{SO}_4]_3$, MgSO_4 , H_2SO_4 , Na_2SO_4 and HCl on the viscosity of bone-china slips and on the plasticity of a bone-china body were deter-

mined. The body used consisted of (%): calcined bone, 48; china clay, 24; Cornish stone, 24; ball clay, 2; bentonite, 2. 4pp 5fig 2tab (BCA) Abstr. No. 2553/67

294

Van der Klugt, L.J.A.R.

Loss of Quality of Extruded Clay Products

Klei Keram. 17(1), 3

In Dutch. Vacuum-extruded products may lose their plastic deformability or even develop internal cracks when they are protected from drying for some time before entering the dryer. This phenomenon is stated to be caused by air solved in the tempering water of the clay under influence of the forming-pressure. When the pressure falls off, the air may be freed. If this happens in small bubbles only, plastic deformability will disappear. If the freed air concentrates at a few points, internal cracks will result. 11pp 8fig 2tab (BCA) Abstr. No. 1487/67

1968 Documents

295

Mass Production of 4-in. Pipes

Br. Clayworker 76(912), 24

The new works of Ellistown Pipes, Ltd at Woodville, England, produces 4-in. pipes in 4-ft lengths. They are taken automatically from the extruder and placed on pallets; fork-trucks lift them to the dryer, in which they remain for 8 1/2 hours. The dried pipes are set by hand on kiln cars. The tunnel kiln is oil-fired through the roof and walls. 5pp 9fig (BCA) Abstr. No. 230/69

296

Albenque, M.

A Note on Brick Production by Two-Layer Extrusion

Terre Cuite 37(2), 14

In French. A 5-10 mm coloured ribbon of clay was extruded through the same die as the bulk of the brick. Only about 10% of the brick volume was thus coloured, but the coloured surface layer was thick enough not to show a different colour if it was chipped during transport and handling. 2pp 1fig (BCA) Abstr. No. 81/69

297

Allegrini, A.P., and T.A. Cecil

Strong Activated Bauxite Aggregates Having a High Surface Area

Patent No. U.S. US 3406125, 15 Oct, 1968, 4 pp. USA

Crushed bauxite containing gibbsite with 50-60% Al_2O_3 and 1-15% SiO_2 is converted to durable porous pellets for use as adsorbents or catalysts by moistening small granules, before calcining, with 50-70% NaOH solution to provide 3-10% NaOH by weight of dry ore, and extruding the plastic mass to 0.2-0.6 in. diameter rods, which are cut to pellet lengths, reacted 45-90 minutes at 275 to 300 degrees F for hardening, and finally activated at 650 to 700 degrees F for 45-120 minutes for calcining to 6-12% volatile matter content. Pellets thus treated have greater than 70% hardness by the "4 ball" test of U.S. 3,078,518, with specific surface area greater than

100 m^2/g . The bauxite is crushed finer than 30 mesh, but powder finer than 60 mesh can be used. When Surinam bauxite containing 31% volatile matter was roll-crushed finer than 28 mesh with 5% through 325 mesh, 45 lb was mixed in a pug mill with 2 kg 50% NaOH solution, giving 7% NaOH by dry weight. The mixture at 105 degrees F was extruded through 3/16 in. holes and reacted 2 hours in an air stream at 300 degrees F. Then the pellets were heated in 30 minutes to 700 degrees F in a rotary dryer and held 1 hour at temperature to lower the volatile matter content to 9.2%. The product had a surface area of 124 m^2/g and samples coarser than 4 mesh had 91% hardness by the 4-ball test, compared to 17% for granular Surinam ore activated at 650 degrees F, without previous NaOH treatment, and having a surface area of 223 m^2/g . The harder material is more useful for removing moisture from organic fluids or gas, for decolorizing oil, wax, or fats, as a desulfurization catalyst, or a carrier for Cr oxide catalysts. (CAS) Abstr. No. CA70(2):5582w

298

Braithwaite, E.R.W.

Machinery

Claycraft Struct. Ceram. 42(3), 75

Equipment (mainly Continental types) for wet preparation of brick clays is described. Mixer filters can replace the usual edge-runner mill; the smallest machine of this type has a throughput of 20 tons/hr, the largest 60 tons/hr. Details of high-speed rolls are given; they are useful in rendering lime nodules harmless. Methods of storing clay are discussed. A steamheated extruder is mentioned that produces 17,000 hollow blocks an hour; the steam heating saved 34 kW in power and reduced drying time by 30%. Some features of de-airing are also discussed. 7pp 10fig (BCA) Abstr. No. 1634/69

299

Chen, Y.M.

A Simple Statistical Theory of the Stress/Strain Relation in Plasticity

Jpn. J. Appl. Phys. 7(6), 567

1968 Documents

(Abstract not available.) (BCA) Abstr. No. 453/69

300

Clarke, B., and J.A. Kitchener

The Influence of Pulp Viscosity on Fine Grinding in a Ball Mill

Br. Chem. Eng. 13(7), 991

There is no unique relationship between the viscosity of the charge in a ball mill and the efficiency of operation. The major effect of deliberately changing the consistency of the charge in a smooth-walled laboratory mill is to alter the whole regime of circulation of the load; consequently the power consumption changes and so do the relative contributions of impact breakage and attrition. When all possible steps are taken to keep the dynamic regime and the work input constant, the yield of products smaller than a specified sieve size is not enormously dependent on the nominal viscosity, but it does pass through a flat maximum around 100 cP, and there is a small minimum around 20 cP. These results are in agreement with the traditional theory that for fine grinding the medium should coat the balls, but not be so thick as to be impenetrable to impacts. The results suggest that even in the laboratory mill used, impact fracture of the feed was never damped by viscosities up to 700 cP, whereas attrition was considerably reduced. Possibly the large particles adhere to the grinding bodies but yet protrude above the coating and so receive full impacts. The minimum around 20 cP is probably associated with changes in the effective friction between coarse particles and the grinding balls and between balls and mill walls. 6pp 14fig (BCA) Abstr. No. 58/69

301

Douma, G.H.

The Shortening of Highly-Plastic Clays by Additions of Calcined Clay or Sand. The Effect on Firing Behaviour and on the Properties of the Unfired and Fired Products

Klei Keram. 18(2), 30

Netherlands

In Dutch. Work carried out on Dutch clays by TNO is described. In general the best results were obtained using calcined clay. 13pp 3fig 5tab (BCA) Abstr. No. 1744/68

302

Ewing, W.A.

Progress in Structural Clay Products

Br. Clayworker 76(910), 30

Concerned chiefly with hollow blocks: their variety in design, mouth-pieces for their extrusion, and U.K. Building Regulations bearing on their use. 3pp 1tab 3fig (BCA) Abstr. No. 2613/68

303

Fielding and Platt, Ltd.

Hydraulic Extrusion Press

Patent No. Brit. GB 1,137,430, 18 Dec, 1968,

A machine for the continuous extrusion of carbon sections has an extruding chamber with two diametrically opposite inlets, and closure member reciprocable from one inlet to the other to close them according to the inlet pressures. Adjacent each inlet is a carbon chamber and a hydraulic ram. Whilst one ram is operative to feed carbon to the extruding chamber forcing the closure against the other inlet, the other ram is withdrawn, allowing charging of the second carbon chamber. (BCA) Abstr. No. 1158/69

304

Gratz, R.

A Quantitative Appreciation of Textural Faults in Ceramic Products and Methods for Their Elimination

Ziegelindustrie 22(9-10), 197

In German. The faults in question are those found in structural clay products that have been extruded. The term "lamination index" is proposed for the ratio of the tensile strength of a sample of the extruded clay when measured in the direction of extrusion to that measured perpendicular to this direction. The manner in which this index varied with the following factors

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was studied: moisture content, degree of vacuum in the pug, volume of air contained in the clay, the amount of non-plastics in the clay. Some correlation with frost resistance was attempted. 7pp 16fig (BCA) Abstr. No. 77/70

305

Hubner, F.

Steam Treatment by Means of Star-Shaped Devices in Auger Machines for Stoneware Pipes--Hot Storage of Ceramic Bodies

Ziegelindustrie 21(2/3), 29

In German. With this star-shaped device, the whole operation of hot shaping is carried out in the pug. An example is given of a vertical pug with a horizontal star-shaped distributor. This method of heating clay can also be adapted to the storage of hot clay ready for use. 5pp 2fig (BCA) Abstr. No. 1742/68

306

Kilgore, R.V., and W.O. Williamson

Extrusion and Microstructures of Clay and Clay-Graphite Mixtures

Am. Ceram. Soc. Bull. 47(8), 707

The flow-point pressure of ram-extruded kaolin-illite clay, with or without admixed graphite, decreased with the water content according to the equations of Stull and Johnson or of Goodson and Hodgkinson. The extruded cylinders showed a planar particle orientation parallel to their curved surfaces, crossed diagonally by slip bands in which the clay platelets were arranged as if the cylinders had been formed by axial tension and radial compression. Graphite flakes prevented the slip bands from developing freely. Stresses during extrusion reduced some graphite flakes to contiguous fragments. Such fractured graphite may have contributed to the low modules of rupture of the dried cylinders. 3pp 3fig (BCA) Abstr. No. 588/69

307

Klaubert, H.

A New Pug With a Slicing Device for Feeding Cup-Making Machines

Glas-Email-Keramo-Tech. 19(9), 324

In German. The barrel is 120 mm diam. There are two pneumatically operated cutting-wires. The clots move onto a band conveyor. 2pp 4fig (BCA) Abstr. No. 590/69

308

Milde, K.

Thirty Years of Hot Preparation

Sprechsaal 101(2), 39

In German. The author recommended hot preparation thirty years ago; this process has become accepted only during the last 10 years. Points that should be watched include: use of saturated water vapour, prevention of cooling of the clay overnight and maintenance of the moisture content between 25 and 40% to ensure a drying shrinkage between 6 and 15%. 3pp (BCA) Abstr. No. 1741/68

309

Oberschmidt, L.E.

Dickey First to Extrude 36-48 Inch Pipe Horizontally

Brick Clay Rec. 155(4), 42

This article is of the question and answer type; it deals with Dickey Clay Mfg. Co., U.S.A. The reasons for choosing horizontal rather than vertical extrusion are given. The shaft in the extruder, which operates under vacuum, rotates at 39 rpm and its capacity is 45 tons/hr. 4pp 19fig (BCA) Abstr. No. 1135/69

310

Ovenston, A., and J.J. Benbow

Effects of Die Geometry on the Extrusion of Clay-Like Material

Trans. Br. Ceram. Soc. 67(11), 543

A comparison is made between expressions developed from published theories describing the extrusion of clay-like materials through dies of various shapes and experimental results on alumina trihydrate, bentonite, water mixtures.

1968 Documents

Data showing the effects of die geometry on pressure/output rates in both a ram extruder and screw extruder are presented. An analysis of these results is made in terms of theories which predict the effects of changes in die length, diameter, and cone angle, in order to illustrate the relative contributions made by different parts of the die to the total flow impedance. 25pp 20fig 1tab (BCA) Abstr. No. 1134/69

311

Packard, R.Q.

Measurement of Aqueous Conductivity of Unfired Ceramic Bodies

Am. Ceram. Soc. Bull. 47(12), 1136

A method for deriving the aqueous conductivity of ceramic bodies from the moisture outflow data obtained with a pressure membrane cell. The technique and analysis are illustrated by results for a brick clay. 2pp 2fig 1tab (BCA) Abstr. No. 1668/69

312

Robinson, G.C., et al.

Raw Material Parameters Determining Extrudability

Am. Ceram. Soc. Bull. 47(9), 822

Raw-material characteristics that determine the internal structure of extruded objects were investigated. Synthetic mixtures were prepared which permitted evaluation of clay quantity, clay mineral, particle size of clay component, particle size distribution of non-plastics and chemical additives. Body composition determined the stress/strain property, differential shrinkage, internal friction, cohesion and adhesion of a body. These properties determined the internal structure of the extruded object. Information obtained on synthetic mixtures was used to predict changes that might correct lamination. 11pp 25fig 3tab (BCA) Abstr. No. 537/69

313

Rose, D.A.

Water Movement in Porous Materials. 3. Evaporation of Water from Soil

Br. J. Appl. Phys. 1, Series 2,(12), 1779

The equation of vertical flow is adapted to describe the evaporation of water from a semi-infinite porous material during the second stage of drying when water loss is limited by the distribution of water in the material. Flow measurements on long columns of aggregates of six soil materials confirm the theory and enable the transport parameters controlling flow to be found over the range of volumetric water content θ (cm³ water/cm³) from aggregate saturation θ_a to dryness (i.e., from near pF 2 to near pF 7). Evaporation from porous materials initially at a uniform water content θ_a produces profiles of θ invariant with $zt^{-1/2}$ (where z is the depth in cm and t the time in seconds) which differ for each material. As θ decreases from θ_a , diffusivities [D cm² s⁻¹] calculated from these profiles fall to a minimum, then rise to a subsidiary maximum close to dryness, before falling again as θ approaches zero. Such behaviour accords with prediction. Hydraulic conductivities [k cm s⁻¹] fall continuously as θ decreases from θ_a to zero. 13pp 5fig (BCA) Abstr. No. 1669/69

314

Smith, D.K., Jr., and S. Weissmann

Residual Stress and Grain Deformation in Extruded Polycrystalline Beryllium Oxide Ceramics

J. Am. Ceram. Soc. 51(6), 330-6

USA

Residual strain measurements on a series of sintered BeO tubes indicate that significant stresses developed during processing from the thermal expansion anisotropy. X-ray topographic studies show that the resulting strains are preferentially located near grain and subgrain boundaries. Fine-grained samples, less than or equal to 20 μ , do not show pronounced subgrain structure and exhibit lower dislocation densities in the grain interiors than do coarse-grained samples. (CAS) Abstr. No. CA69(6):21656h

1968 Documents

315

Tesla, N.P.

Extrusion Press

Patent No. Brit. GB 1,133,011, 6 Nov, 1968,

A machine for extruding ceramic in the plastic state has a chamber containing electrodes for passing current through the material being extruded. The electrodes cover parts of the chamber wall symmetrically relative to its axis. When the electrodes are connected to a potential source, an electric field is produced in the material in the chamber, heating the extruded material uniformly. (BCA) Abstr. No. 1150/69

316

Van der Kragt, L.J.A.R.

The Shortening of Highly-Plastic Clays

Klei Keram. 18(1), 2

In Dutch. The addition of precalcined clay to highly-plastic clay to facilitate drying and firing was studied. (BCA) Abstr. No. 1743/68

317

W.T. Copeland and Sons, Ltd.

Pug Mill

Patent No. Brit. GB 1,127,808, 18 Sep, 1968,

A pug for removing occluded air from potter's clay has a rotating helical screw which forces the clay into an evacuated chamber through a perforated plate, the holes in which taper and slope upwards into the chamber at 20 degrees to 28 degrees to the horizontal, so that ribbons of clay fall, and stretch, in the chamber to improve air removal. The plate may have holes of three sizes, the largest being near the periphery and having the greater slope. Clay passes from the chamber into an extrusion press. (BCA) Abstr. No. 87/69

318

Wadhwa, S.S.

Recent Trends in Auger Designs for Clay Extrusion

Claycraft 41(5), 140

Augers are divided into two types: those in which the displacement volume per revolution is constant in all pitch sections of the auger, and those in which this volume varies along the auger. The mathematics of the two types are considered. Some mechanical and physical factors affecting design are noted. 3pp 5fig 2tab (BCA) Abstr. No. 2027/68

319

Williamson, W.O.

Dimensional Changes and Micro-Structures of Unfired Clay Products

Interceram 17(3), 199

Unfired clay products change in dimensions when they lose or gain water. The linear changes are commonly greater perpendicular rather than parallel to the plane in which the clay platelets tend to be oriented. Anisotropic drying-shrinkage is enhanced by added graphite flakes but reduced by non-plastic particles that are not markedly flat. If fabrication processes separate these particles more widely in one plane than in planes perpendicular thereto, the drying-shrinkage in this plane may be relatively greater because of the greater average thickness of plastic clay between the particles. The greater shrinkage may be perpendicular to the direction predicted from the preferred orientation of the clay platelets. Shrinkage in a particular direction may vary because uneven moisture-contents are produced during deformation, casting, or drying. Moisture differences persist because water-movement is controlled by differences in the potential energy of the water rather than by the clay-water proportions. These proportions may vary with local differences in the micro-structure, yet the water involved may be in energetic equilibrium. Linear changes caused by recovery from deformation are superimposed additively or subtractively on those due to the loss or gain of water. Recovery may cause specimens to curve during drying in a sense opposed to that predicted from the moisture-gradients accompanying desiccation. 6pp 6fig (BCA) Abstr. No. 601/69

1969 Documents

320

Methods for Reducing Lamination During Extrusion

Ziegelindustrie 22(13-14), 305

In German. The article is based largely on Russian reports and concerns modifications to the blades and to the mouth-piece; it is useful to be able to adjust the mouth-piece length. Some advantage is claimed for vibration of the extruder at 3000 cycles/min, the amplitude of vibration being 0.5-1 mm. 3pp 5fig (BCA) Abstr. No. 78/70

321

Urethane Rubber Extends Muller Life, Reduces Sticking

Ceram. Age 85(3), 20

A muller-mixer is used at a U.S. refractories works for the mixing of chrome ore and magnesite with H_2SO_4 as a chemical binder. After 16 months use it would seem that a urethane rubber coating on the wheel treads and bottom liners will double the life. 1p 2fig (BCA) Abstr. No. 2858/69

322

Atkinson, C.R.

Quarrying and Clay Preparation

Br. Clayworker 78(920), 26

The importance of an informed evaluation of a clay deposit prior to its exploitation is emphasized. The principles of quarrying and clay preparation are set out. If a material can be found either wet or dry, the wet process is preferable because it combines grinding with tempering and is also less subject to output fluctuations. 3pp (BCA) Abstr. No. 2227/69

323

Bohm, J.

Steam Preparation of Clays

Ziegelindustrie 22(11-12), 254

In German. Superheated (180-350 degrees) steam is generally preferable to low pressure steam, of which 150 kg is needed to treat 1000

bricks, whereas only 90 kg of high pressure steam is required. Drying time in either case is reduced by 40-70%, and output of the pug is 8-10% higher. 6pp 7fig (BCA) Abstr. No. 76/70

324

Braithwaite, E.R.W.

Machinery for Wirecut Brickworks

Br. Clayworker 78(921), 15

Machines made by the following firms are described: Bedeschi, Handle, Concordia, Bongioanni, Frey, Steenbrugge, Zehner, Keller. 6pp 9fig (BCA) Abstr. No. 2864/69

325

Christensen, R.W., and J.S. Kim

Rheological Model Studies in Clay

Clays Clay Min. 17(2), 83

The process of deformation in clays is visualized as the combination of recoverable deformation resulting from bending and rotation of individual particles and irrecoverable deformation due to relative movement between adjacent particles at their points of contact. The relative movement between particles is treated as a rate process in which interparticle bonds are continually broken and reformed as the deformation proceeds. Accordingly, the rate of deformation is governed by the activation energy associated with the rupture of interparticle bonds. Thus, in terms of rheological model, the fundamental element consists of a spring, representing the recoverable deformation, in series with a rate process dashpot representing the irrecoverable deformation. Owing to the heterogeneous nature of the fabric of clay soils, i.e., varying particle size, shape, orientation, surface characteristics, etc., a wide range of activation energies, elastic stiffness, and other material properties is anticipated. This is accounted for by assuming a Gaussian distribution for the model properties. Thus, the complete rheological model postulated in this study consists of a combination of spring and dashpot elements covering the complete spectrum of model properties. The response of the rheological model is analyzed for creep and constant strain-

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rate loading. The analysis is accomplished numerically using a digital computer because no closed form solution exists for the non-linear systems of equations that result from this model. Experimental data for a number of triaxial tests on clays under various conditions of loading are presented for comparison with the model behaviour. (BCA) Abstr. No. 9/70

326

Franklin, A.G., and R.J. Krizek

Complex Viscosity of a Kaolin Clay

Clays Clay Min. 17(2), 101

The complex viscosity of a material is a two-component quantity, comprising real and imaginary parts. The real part of the complex viscosity is often very useful because in many materials it approaches the ordinary steady-flow viscosity at low frequencies. Because many materials with high viscosities are very slow in reaching a steady-flow condition, the determination of the steady-flow viscosity may be very difficult; however, an approximation can often be obtained from low-frequency values of the real part of the complex viscosity. In this study, the complex viscosity of a Georgia kaolin has been determined by measurements made on specimens subjected to oscillatory simple shear, over three decades of frequency. Other independent variables in the study are the water content of the clay and the shear strain amplitude. Data were obtained from experimental measurements in the form of values of the magnitude, or absolute value, of the complex viscosity, and the phase angle between the imposed oscillatory strain and the stress response. (BCA) Abstr. No. 10/70

327

Gippini, E.

The Atterberg Limits and the Moulding Properties of Brick-Making Bodies

Trans. 11th Int. Ceram. Congr. 1968, p. 535

In French. A systematic investigation of the Atterberg limits for bodies comprising two clays and a series of deflocculants has established the relationship between the amount of deflocculant

in a body and the plasticity index as linear. A study of the casting and drying characteristics of various raw materials and application of the Casagrande diagram, widely used in soil mechanics, has enabled an easy and rapid procedure to be established whereby the optimum proportion of mixture of several raw materials can be determined so as to provide the best drying and casting characteristics at the same time. 15pp 9fig 4tab (BCA) Abstr. No. 1753/70

328

Harmathy, T.Z.

Simultaneous Moisture and Heat Transfer in Porous Systems with Particular Reference to Drying

Ind. Eng. Chem. Fundam. 8(1), 92

Based on an examination of the liquid-vapour equilibria and of the mass and energy transfer processes in porous systems, a theory has been developed for simultaneous mass and heat transfer during the pendular state of such systems. A set of differential equations is presented which, when solved with the appropriate initial and boundary conditions, yields the complete moisture content, temperature, pressure history of the system. By theoretically simulating various drying processes it is shown that during the falling rate period the evaporation-condensation mechanism is the governing mechanism of drying. The application of the theory to transient heat conduction in the presence of moisture and to transient vapor transfer through porous media is also illustrated. 10pp 9fig 4tab (BCA) Abstr. No. 2899/69

329

Hepworth Iron Co., Ltd.

Pipe-Making Apparatus

Patent No. Brit. GB 1,141,065, 22 Jan, 1969,

Equipment to compress clay particles having a moisture content less than 1% and then to extrude a pipe under high pressure includes a vertical cylinder forming a female die. A tubular plug is fitted in the lower end of the cylinder. A piston extends through the plug and carries an

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enlarged head at its upper end. The head is of smaller diameter than the bore of the cylinder and forms a male die which defines an annular extrusion passage with the inner surface of the cylinder. The annular chamber between the cylinder and piston is first filled with clay, and the particles are compressed by movement of the piston head towards the plug. After compacting of the clay it is extruded as a densely consolidated mass with a pressure greater than 750 lb/in.² at the extrusion outlet. (BCA) Abstr. No. 1841/69

330

Hofmann, U., et al.

Measurements of the Plasticity of Kaolins and Clays

Ber. Dtsch. Keram. Ges. 46(6), 293

In German. The best method of measuring plasticity is by determining the strength of the body for a water content giving a reasonable consistency, as measured, for instance according to Pfefferkorn or Cohn. But if clays at this consistency are tested for their tensile strength by the method of Linseis, Scharrer and Hofmann, the extension of the extruded column is so high that the method can no longer be used with clays (as distinct from kaolins). With the latter one can just about obtain values roughly corresponding to the Pfefferkorn or Cohn numbers. With a slightly lower water content, the tensile strength of clays can be measured and gives a satisfactory agreement with the Pfefferkorn and Cohn values. According to these measurements clays are no more plastic than kaolins, although according to Rieke or Atterberg Values they cover a wider range. Furthermore, clays show an appreciably higher dry bending strength. The results are discussed with particular reference to specific surface, cation exchange and the size of the clay mineral plates. 6pp 11fig 1tab (BCA) Abstr. No. 515/70

331

Lengersdorff, G., and H. Rohr

Modern Methods of Preparation in the Pottery Industry. Pt. 1

Keram. Z. 21(7), 428

In German and English. Notes are given on a cooperative body-preparation plant designed to supply the various pottery factories in Selb (Bavaria). The present capacity is 1500 tons/month; half is for plastic shaping and half for casting. Five types of body are supplied, some maturing at 1050 degrees, others at 1180 degrees. The bodies for jiggering have an initial moisture content of 35% which is reduced to 20 percent by spray drying. 4pp 3fig (BCA) Abstr. No. 662/70

332

Pels Leusden, C.O.

The Influence of Extrusion on the Properties of Bricks and Tiles

Klei Keram. 19(7), 170

In Dutch. The common faults in extrusion are illustrated; they can be largely prevented by the use of a correctly designed mouth-piece. The article is of a general nature. 12pp 13fig (BCA) Abstr. No. 79/70

333

Putin, E.

Clay-Cutting Machine

Patent No. Brit. GB 1,149,877, 23 Apr, 1969,

This machine assists rapid mass-production of bricks. Lengths of clay are advanced along a motorised roller conveyor in batches and onto a second roller conveyor which is grooved to receive the bars of a rectangular framework. A feeler senses the presence of the clay bars and signals the frame to rise, rotate through 90 degrees, and deposit the bars back on the rollers. They then advance to a multiple cutting unit where they are cut into suitable brick lengths. (BCA) Abstr. No. 2284/69

334

Reh, H.H.

The Conditions of Flow in Ceramic Bodies in De-Airing Pugs

Sprechsaal 102(21), 958

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In German. The flow was studied by introducing quantities of different coloured bodies into the pug, then sampling the body at the die, at the spacer and along the screw. Cross-sections of the body exhibit streaks and colour variations, showing the relative displacements of the various parts of the body. A direct relation is shown between the speed of rotation and the profile of the screw. The spacer should be as long as possible. An outline theory relates the pressure of the body towards the die with other factors. The best profile for a split mouthpiece was not found. The correct screw profile and the ratio between the length of the spacer and the diameter of the pug are discussed. 7pp 14fig (BCA) Abstr. No. 1754/70

335

Reis, H.R.

Contribution to Spray Drying of Ceramic Bodies with Subsequent Plasticizing

Interceram 18(3), 198

Several types of spray dryers are described. They have outputs up to 7000 kg/hr. The upper size limit of the product is 300 μ m. The heat consumption is 800-1000 kcal/kg of water evaporated, and the power consumption is 10-20 kWh/ton of body. To produce a body for plastic shaping, part of the slip is dried to 5-8% moisture; a weighted amount of this moist powder is fed to a counter-flow mixer together with a measured volume of slip and the mixed batch is then pugged. 3pp 9fig (BCA) Abstr. No. 1192/70

336

Schlinkert, C.

The Detection and Elimination of Shaping Faults in the Production of Clay Building Products

Ziegelindustrie 22(7-8), 167

In German. This article is chiefly concerned with extrusion faults. Many examples are illustrated, and opinions are expressed on the features of extruder design to which these faults are attributable. 12pp 49fig (BCA) Abstr. No. 2865/69

337

Schmidt, E.W.

Dry-Pressing Heavy-Clay Products

Sprechsaal 102(2-3), 62

In German. The preparation processes for extrusion (19-24% or 13-14% moisture) and for dry-pressing (6-9% moisture) are described. Available equipment is discussed critically. 10pp 24fig 2tab (BCA) Abstr. No. 2250/69

338

Schneider and Co.

Ceramic Tubes

Patent No. Brit. GB 1,139,827, 15 Jan, 1969,

Ceramic tubes having parallel channels extending from end-to-end through their walls are made by extruding the material through a dieplate having a number of orifices, each orifice being masked on the outlet side by a plate which is spaced away from the dieplate. Each masking plate is attached to a short tubular insert, the end remote from the masking plate being secured in the die-plate and the wall of the insert between the dieplate and the masking plate having lateral openings through which the paste flows. (BCA) Abstr. No. 1649/69

339

Schutten, M.

Reducing the Loss in Grinding of Extruded Al_2O_3

Patent No. Ger. Offen. DE 1800699, 8 May, 1969, 19 pp.

Netherlands

In German. Extruded Al_2O_3 is calcined at 450-850 degrees, wetted with 50-100 weight % water, submitted to an abrasion treatment, dried and calcined again. The abrasion treatment consists of a vibration (frequency 20-100 vibrations/min) or a rotating in a concrete mixer (60-80 cycles/min) for at least 10 minutes. The Al_2O_3 is very suitable for being used as support for a Pt catalyst. (CAS) Abstr. No. CA71(8):31887q

1969 Documents

340

Shaw, K.

Updating Clay Product Drying Processes. Pt. 1

Br. Clayworker 78(928), 38

Recent Russian research is reviewed. The rate of evaporation from a clay surface and moisture movement from the interior to the outer layers are considered, and equations are developed. Shrinkage and warpage during drying are also discussed. 4pp 1tab (BCA) Abstr. No. 687/70

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341

Moisture Content in Making, Rate of Diffusion, Residual Moisture Content, and Technical Developments. Pt. 1.

Ziegelindustrie 23(1-2), 14

In German. The usual method of preparing heavy-clay bodies is reviewed, and variants are suggested based on the introduction of new German and Italian machinery, details of which are given. 7pp 16fig 2tab (BCA) Abstr. No. 2498/70

342

Working Moisture Content, Diffusion Rate, Residual Moisture and Technical Developments. Pt. 2

Ziegelindustrie 23(3-4), 62

In German. The temperature and rate of circulation of air and its relative humidity are related to the evaporation of moisture during making. The role of the diffusion coefficient of the water in the pores of the body is studied. Hot shaping reduces drying time. In old brickworks, in summer open-air drying was used to increase drying capacity. A special method of operation should be followed to avoid the formation of cracks and to maintain equilibrium between the residual moisture in the brick and the relative humidity of the atmosphere. 3pp 5fig (BCA) Abstr. No. 2553/70

343

Adams, A.B.

A New Method of Drying Heavy Clayware

Claycraft Struct. Ceram. 43(3), 21

A method has been developed for distributing air through large masses of clayware on pallets or bricks, making maximum use of low-pressure air flow. The basis of the method is the use of a reversing axial flow fan and an arrangement of heating and exhaust air connections that ensures that freshly heated air cannot be drawn out through the exhaust. 1p 2fig (BCA) Abstr. No. 2558/70

344

Churakova, R.S., and E.P. Fedorova

Investigation of the Drying Process in Fine-Grain Alumina Articles

Refractories 35(8), 502

The formation of Al hydrates and polyoxychloride during acid treatment to remove iron, and its effect on the grinding of the products was studied in slips prepared from raw alumina, from alumina calcined at 1400 degrees, 1600 degrees and 1700 degrees, and from electrofused alumina. The slips were examined by electron microscopy, X-ray analysis and dta. The amount of hydrate and oxychloride formed was determined by measuring loss-on-ignition between 200 degrees and 1000 degrees. An economic drying cycle was set up from the study of loss of moisture. (BCA) Abstr. No. 3691/71

345

English Clays Lovering Pochin and Co., Ltd.

Treating Particulate Materials

Patent No. Brit. GB 1,194,866, 17 June, 1970,

Clays and chalks of particle size less than 75 μm are passed through a pug-mill having a L/D ratio of 4:1 to 10:1, preferably 7.5:1, the energy dissipated in the material being greater than 10 H.P. hours/ton. The energy input may be increased to 50-150 H.P. hours/ton. The initial particle size may be less than 10 μm , and when the material is clay it has a moisture content of 20-28%. The energy dissipated is controlled by automatically adjusting the extrusion orifice size according to the load on the driving motor. The process is useful for improving clay strength for ceramic manufacture. (BCA) Abstr. No. 3292/70

346

Entelis, F.S., and N.A. Khurgina

Method for the Determination of the Plasticity of Fine Ceramic Bodies

Glass Ceram. (Engl. Transl.) 27(3), 161

An apparatus equipped with cine film recording was used to study rods extruded from a porcelain body of a moisture content of 22 or 24%; the rate

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of deformation may vary from 0.5 to 625 mm/s; the stresses applied were linear or bilateral tensile, and longitudinal compressives. The moist sample, being slightly electrically conductive, is used to complete an electric circuit which is automatically broken when the sample ruptures. The techniques of preparing the test-pieces and fixing them in the apparatus are described. The influence of the rate of deformation as plasticity is confirmed, and a quantitative relationship is given. The effect of the rate of deformation on the critical deformation is also shown. An interpretation of the results is based on the type of deformation and fracture. 5pp 6fig (BCA) Abstr. No. 1583/71

347

Haring, J.

Storing--Souring--Tempering

Ziegelindustrie 23(3-4), 76

In German. The significance of these terms in the heavy-clay industry is discussed generally. Tempering is mixing the clay with the right amount of water for making. After a time, depending on the properties of the clay, part of the clay passes into colloidal solution with uniform wetting of the grains. Souring consists of wetting the pre-ground material and leaving it to stand. After a time a plastic body suitable for making is obtained. In making bricks the souring time is reduced by mixing in a closed chamber. The quality of the body is not always as good as that from prolonged natural ageing, but is often good enough. 1p (BCA) Abstr. No. 2497/70

348

Hopfner, P.

Water-Soluble Cellulose Ethers as Binding and Plasticizing Agents in Ceramic Bodies

Interceram 19(2), 149

A study was made of the possible uses of carboxymethylcellulose, methylcellulose and hydroxyethylcellulose as binders and plasticizers in bodies for plastic making, slip casting, wet or dry pressing, or extrusion. For each process the

conditions of use, suitable quantities, and the effect on the workability and mechanical strengths are given. 3pp (BCA) Abstr. No. 3270/70

349

Nakhamkin, M.A.

Plastic Moulding by Ultrasound

Glass Ceram. (Engl. Transl.) 27(8), 479

The technique is intended for shaping plastic porcelain bodies and depends on the temporary but complete disruption of structure in the body, using ultrasonic vibrations. Inhomogeneity and traces of previous production operations on the body are thus eliminated. The artificially "liquid" free-flowing body is then shaped, the ultrasonic field removed, and the article hardens instantaneously by a thixotropic action. 4pp 6fig (BCA) Abstr. No. 3121/71

350

Nitzenadel, P.

The Flow Behaviour of Plastic Ceramic Bodies

Silikattechnik 21(3), 86

In German. Flow curves recorded by a special rotary viscometer showed pseudoplastic flow for plastic ceramic bodies at making consistency, Bingham flow at higher moisture contents. Viscosity decreases with the rate of deformation. The bodies behave towards non-plastic materials and fluxes like casting slips, and their viscosity decreases with increasing temperature. By calculating an apparent viscosity a convenient practical index is obtained for the consistency. 4pp 8fig (BCA) Abstr. No. 3271/70

351

Pels Leusden, C.O.

Mouthpiece Design for Low-Stress Extrusion

Ber. Dtsch. Keram. Ges. 47(6), 345

In German. In view of the fact that differences in the flow rate of different "strands" in the clay column set up stresses in extruded products, a

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method was developed to determine the resistance of mouthpieces as a function of their geometrical shape. This was used as a basis for mouthpiece design, since it is recognized that the rate of flow across the column is only truly uniform if the resistance in the mouthpiece is the same at all points. 6pp 10fig 1tab (BCA) Abstr. No. 3272/70

352

Pels Leusden, C.O.

On the Plastic Flow in a Parallel Plate Plastometer

Tonind. Ztg. 94(3), 89

In German. The set of equations given by v. Mises for the deformation of an ideal plastic body in plastometers have been solved for the biaxial state of stress, and the flow profile for large deformations is calculated. Experimental investigations with a plastic clay confirm the theoretical results. At low rates of deformation in the plastometer elliptical and, in particular cases, semicircular deformation profiles occur, together with block flow instead of the normally expected parabolic flow profiles. 5pp 12fig (BCA) Abstr. No. 3876/70

353

Samanta, S.K.

Slip-Line Field for Extrusion Through Cosine-Shaped Dies

J. Mech. Phys. Solids 18(5), 311

The slip-line field solution is proposed for the steady-state plane strain extrusion of rigid/perfectly-plastic material through a frictionless cosine-shaped die. The extrusion pressures are calculated for various different reductions. From numerical calculations the extrusion pressure $P/2k$, has been determined as $1.02 \ln(1/R)$, where P is the extrusion pressure, $2k$ is the yield strength of the strip, and R is the desired reduction of the die, which is nearly equal to the work density for homogeneous compression. The calculated extrusion pressures were compared with those of axisymmetric extrusion and found to be somewhat smaller. The validity of this solution

for the range of reductions is given. 8pp 4fig (BCA) Abstr. No. 1259/71

354

Schlegel, D.

Investigation on the Rheology of Plastic Ceramic Bodies

Ber. Dtsch. Keram. Ges. 47(12), 774

In German. In plastic ceramic bodies subjected to low shear stresses in Couette-type flow, discontinuous deformation processes and lamination phenomena occur. If the mean shear rate is high, the material behaves as a homogeneous continuum. In this case the shear stresses can be determined from the values measured taking into account the slipping along the walls. Slipping must not be ignored even with heavily profiled walls. Shear stress functions of plastic ceramic bodies are nonlinear. 6pp 6fig 1tab (BCA) Abstr. No. 2357/71

355

Schmidt, H.

Methods of Studying Heavy-Clay Raw Materials

Sprechsaal 103(18), 812 (Pt. 2); 104(2), 83 (Pt. 3); 104(6), 245 (Pt. 4); 104(7), 296 (Pt. 5); 104(8), 327 (Pt. 6); 104(13), 573 (Pt. 7); 104(18), 791 (Pt. 8); 105(13), 508 (Pt. 10); 105(14), 604 (Pt. 11); 105(23), 971 (Pt. 12); 106(4), 148 (Pt. 13); 106(5), 193 (Pt. 14); 106(6), 226 (Pt. 15); 106(7), 273 (Pt. 16); 106(11), 468 (Pt. 17); 106(23), 938 (Pts. 19 and 20); 107(2), 36 (Pt. 21)

1970-1974

Title varies. In German. A twenty-one part series covering topics such as the following: particle size distribution; drying behavior; bending strength; Bigot curve measurement; plasticity tests; mineralogical composition; analysis procedures, sulphates and sulphides; soluble salt determination; plasticity and flow capacity; calculation of force on the die; extrusion faults; hot-stage microscope operation; acid and solvent resistance testing; and frost resistance.

1970 Documents

356

Schwiete, H.E., et al.

The Drying Behaviour of Cast Ceramic Bodies

Ber. Dtsch. Keram. Ges. 47(5), 300

In German. The distribution or diffusion of Na_2CO_3 , used as a slip deflocculant, was studied with the aid of radioactive ^{14}C . It was found that at slow drying rates, i.e., as those commonly employed, there is no measurable accumulation of ^{14}C (and thus of Na_2CO_3) on the drying surface. At very rapid drying rates there occurred on the drying surface a concentration maximum which then decreased during further drying. The next point was to investigate the expansion/contraction behaviour of kaolinite, fireclay, illite and montmorillonite as a function of shaping, shortening and grain size. The fact that expansion and contraction occur in different moisture-content regions affords a possibility of producing low-shrinkage or low-expansion bodies by suitable combination of raw materials. 6pp 13fig 1tab (BCA) Abstr. No. 3313/70

357

Service (Engineers), Ltd.

Extrusion of Uniform Clay Pieces for Manufacture of Pottery Ware

Patent No. Brit. GB 1,211,850, 11 Nov, 1970,

Clay is fed into a chamber, the chamber is evacuated of air, and the clay is intermittently worked whilst steam is injected into the chamber. The clay is extruded, and, during intervals between working, the extrusions are cut away. Specifically, the steam is superheated. Apparatus is also described. The process relates especially to the manufacture of hollow-ware, such as cups. (BCA) Abstr. No. 1648/71

358

Shaw, K.

Rapid Drying in Existing Driers. Pt. 2

Br. Clayworker 79(932), 40

Recent Russian work, chiefly on tunnel driers, is reviewed. The temperature at the entrance is

raised from 100 degrees to 130 degrees. Relative humidity at the entrance and exit are 85-90% and 70-75% respectively. Gas velocity in the hot zone was increased from 1.5 to 18 m/s, and recirculation schemes were introduced. Dividing walls built in existing multi-track driers allowed the use of drying gases at much higher temperatures. The results in service are discussed. 5pp 3fig 1tab (BCA) Abstr. No. 2555/70

359

Suchowski, (NI)

Modern Aspects of the Preparation of Heavy Clays

Oesterr. Keram. Rundsch. 7(1/2), 9

In German. Dry preparation is claimed to be the best method for removing chalk, pyrites and organic materials from clay. The particle size of the clay should be kept less than 0.2 mm and the moisture content at 1-2%. Dry preparation need not be more difficult than wet. The cost per ton is between 1 and 4 DM. 2pp (BCA) Abstr. No. 2496/70

360

United Kingdom Atomic Energy Authority

Production of Zirconium Nitrate Compounds for Plasticizing Zirconia During Extrusion

Patent No. Brit. GB 1,181,794, 18 Feb, 1970,

Water-based Zr nitrate solution or gel has a molar ratio nitrate/Zr of 1-1.1, with optional additions of Ca or Y nitrates and may be made in the solution form by mixing the hydroxide or carbonate of Zr in aqueous solution with HNO_3 followed by heating and optional addition of Ca or Y nitrate (to act as a sol stabiliser). The solution may be dried at 80-90 degrees to produce a water-dispersible gel or it may be suspended in an inert liquid followed by addition of an amine which is soluble in the inert liquid to produce irreversible denitration of the solution. (BCA) Abstr. No. 2234/70

361

Usatkov, I.F.

1970 Documents

Hollow Fiber Extruded from Pure Oxides

Sb. Nauchn. Tr., Ukr. Nauchno.-Issled. Inst. Ogneuporov 13(169-73)

USSR

Two devices were designed for the preparation of hollow ceramic fibers from Al_2O_3 , MgO , and ZrO_2 . The fiber had a diameter of 1 mm, an inside diameter of 0.4-0.25 mm and a porosity of 0.2-1%. The electric resistance was 0.8-0.9 at 1970 degrees, 0.2-10.5 (depending on the purity) at 2040 degrees, and 0.001-0.01 ohm m at 2050 degrees, for Al_2O_3 , MgO , and ZrO_2 , respectively. (CAS) Abstr. No. CA78(22):139642g

362

Van der Klugt, L.J.A.R.

The Drying Time of Heavy Clay Shapes

Klei Keram. 20(5), 114

In Dutch. The clay-water interaction was studied by measuring the specific surface by ethylene glycol adsorption. A survey in the brick and tile industry showed that specific surface measurements were the most useful in studying drying times. 15pp 8fig (BCA) Abstr. No. 3311/70

363

Veb Keramikmaschinen Gorlitz

Ceramic Pipe Extrusion Press

Patent No. Brit. GB 1,210,750 28 Oct, 1970,

In this press clay is fed into a horizontal mixing trough in which is mounted a shaft having mixing vanes and an advancing screw. The trough terminates in a sharp V-blade, which divides the clay flow into two vertical press cylinders, housing a floating press screw. Completed pipes thus emerge alternately from each press. Each press is split longitudinally, and the outer half can be hinged open to give easy access to the internal parts. Both the advancing screw and the screws are driven through gearing from a common motor. (BCA) Abstr. No. 1276/71

364

Veb Keramikmaschinen Gorlitz

Ceramic Pipes Grooving Apparatus

Patent No. Brit. GB 1,210,647, 28 Oct, 1970,

In this apparatus the grooving roller is mounted on an arm attached to a shaft, which rotates in a ring surrounding the pipe extruding machine. When the pipe is ready for grooving, the ring is driven by a motor and chain, so that for the first quarter revolution, the arm is guided in by a roller to contact the pipe, during the next half revolution, the grooves are cut, and during the final quarter the arm is retracted. An identical roller and arm is mounted opposite the first and interconnected by a second chain, so that it copies the movement of the first roller. (BCA) Abstr. No. 1275/71

365

Veb Keramikmaschinen Gorlitz

Vertical Pipe Extrusion Press

Patent No. Brit. GB 1,210,334, 28 Oct, 1970,

This press, for producing clay pipes with a socketed end, has a vertically movable press table on which is mounted a cutter disk for trimming the socket to length and a shaft which passes through the disc. A ram acts on one arm of a two-arm lever to turn the shaft such that a grooving roller on an arm on the shaft is forced into contact with the socket bore to groove the latter. A spring resists the ram to return the shaft. (BCA) Abstr. No. 1274/71

366

Veb Keramikmaschinen Gorlitz

Automatic Apparatus for Earthenware or Stoneware Pipes

Patent No. Brit. GB 1,216,807, 23 Dec, 1970,

Apparatus comprises multiple extrusion press with vertical extrusion cylinders. Pipes formed in the press are supported by vertically movable tables each guided and moved by apparatus mounted in the housing support stand. Pipes are removed from the table by a conveyor running between the stand and a grip on each table. (BCA) Abstr. No. 2198/71

1970 Documents

367

Worrall, W.E., and J.K. Jones

Additives Can Reduce Drying Shrinkage

Br. Clayworker 79(934), 42

Surface-active agents can reduce drying shrinkage by 50%, either by decreasing the initial

moisture required for forming, or by increasing the critical moisture, or both. Na salts of aromatic sulphonic acids were most effective, but K and NH_4 salts were also good. The deflocculating powers and effects on drying shrinkage of some 30 reagents are given. 3pp 2tab (BCA) Abstr. No. 2549/70

1971 Documents

368

Research on New Products

Tuiles et Briques (85), 40

In French. Brief notes are published on formed clay, double-layer extrusion to produce a decorative surface layer on a brick, and a storey-height extruded block. (BCA) Abstr. No. 3218/71

369

**Arakawa, M., S. Banerjee, and W.O. Williamson
Extrusion Behaviour of Hard Shale**

Am. Ceram. Soc. Bull. 50(11), 929

A ground shale containing cemented mineral aggregates and fine micaceous flakes, mixed with flocculating or dispersing aqueous solutions and ram-extruded, obeyed the expression $P = A^{-\alpha(\phi - \phi_0)}$ where P was the pressure which initiated extrusion, ϕ was the volume fraction of liquid, and A and α were constants. For five different mean particle-diameters, plots of $\log P$ against ϕ converged on common points, coordinates $\log P_0$ to ϕ_0 irrespective of the flocculation or dispersion of the system. Pressures P_0 , unobtainable in the equipment, would probably fracture particles during extrusion because the limiting volume fraction ϕ_0 was relatively small. The slopes $-\alpha$ were less for flocculated than for dispersed particles, and they were less for smaller mean particle diameters in both flocculated and dispersed systems. 3pp 1fig 2tab (BCA) Abstr. No. 72/1288

370

Bain, J.A.

A Plasticity Chart as an Aid to the Identification and Assessment of Industrial Clays

Clay Miner. 9(1), 1

The plastic properties of clays are sufficiently variable to offer a simple but practical aid to identification, using their Atterberg "plastic limit" and "plasticity index" values as parameters. The advantages and disadvantages of the technique are discussed, and results for a wide variety of clay minerals, particularly industrial

clays, are illustrated. A brief summary is given of the effect of non-clay impurities, with reference to the correlation of Atterberg limit values with other physical properties of clays. 17pp 6fig 1tab (BCA) Abstr. No. 72/0725

371

Boyarina, I.L.

Improving the Plastic Properties of Kaolins and Kaolin Bodies by Electrohydraulic Processing

Refractories 12(9), 614

(Abstract not available.) 2pp 1fig (BCA) Abstr. No. 73/0317

372

Crandall, S.H., et al.

On the Measurement of Poisson's Ratio for Modelling Clay

Exp. Mech. 11(9), 402

Resonance testing showed plasticine clay, for small strains (less than or equal to 10^{-5}) in the frequency range 100-3000 Hz, to be a linear viscoelastic solid with parameters which depend on temperature, frequency and prior large-strain history. To measure Poisson's ratio, it is necessary to take special precautions to eliminate large straining between small-strain tests of different tensorial character. A simple but effective test configuration is described and test results are displayed. 6pp 9fig (BCA) Abstr. No. 72/1839

373

Entelis, F.S., and N.A. Khurgina

A Method for the Determination of the Plasticity of Some Fine Ceramic Bodies

Sprechsaal 104(24), 1109

In German. Apparatus is described which measures the index of plasticity of a body. This index is defined as the maximum value of an exterior force which when applied to a certain volume of body, can change its shape without modifying the volume. The apparatus is made up of a plaster mould in which the sample of body is enclosed, and an arrangement for measurement and obser-

1971 Documents

vation allowing the tensile stretching of the sample. The behaviour of the sample may be determined photographically, including the instant when the sample breaks. The result depends on the composition of the body and also its moisture content, as well as the speed at which the force of deformation can be increased. The sample of body must be previously extruded under specific conditions. It is concluded that bodies should be shaped as quickly as possible. This increases their plasticity. 4pp 6fig (BCA) Abstr. No. 72/2579

374

Eustaccio, C.

New Methods of Automation--Stiff Extrusion in Germany

Keram. Z. 23(2), 74

In German and English. The new, completely automatic brickworks of Wilhelm Roben at Bannberscheid produces 70 million common and facing bricks per year, with 40 workers in two shifts. The natural gas fired tunnel drier and kiln work 7 days/week, using 600-700 kcal/kg fired. The body is extruded at 14-16% moisture content. The kiln is 175 m long and fires to 1320 degrees. Lingl equipment is used. 3pp 8fig (BCA) Abstr. No. 3124/71

375

Fawcett, J.D.

Horizontal Stiff Extrusion of Sewer Pipes

Br. Ceram. Rev. (9), 20

A brief note on the advantages of horizontal extrusion. Fawcett machinery is described. 2pp (BCA) Abstr. No. 72/0800

376

Haring, J.

Apparatus for Measuring Flow Under Pressure

Ziegelindustrie (5), 217

In German. Measurement of the pressure exerted by a ceramic body on the interior walls of an extruder is made by means of an apparatus

wrongly called a "plastometer." This apparatus does not actually give any indication of the plasticity or suitability for shaping of a body. It simply constitutes a hemisphere onto which the pressure of the body is applied, and which transmits this pressure by means of a spring to a needle on a graduated scale. With this apparatus it is possible to know the pressure of the body at any given moment. The ammeter indicating the consumption of electrical energy by the machine only partly reveals the pressure inside the extruder, as the energy consumption is also a function of the amount of material discharged. Knowing the value of the flow under pressure, by means of the above apparatus, makes it possible to avoid certain shaping accidents. 1p (BCA) Abstr. No. 72/1212

377

Horvath, E.

Extruded Catalyst for Hydrogenation-Desulfurization of Residual Oils

Patent No. Ger. Offen. DE 2056876, 3 Jun, 1971; U.S. US Appl. 21 Nov, 1969, 11 pp.

Title catalyst was manufactured by peptization of $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$ - MoO_3 mixture with HNO_3 addition of CoCO_3 and aqueous NH_4OH , extruding the mixture, drying and calcination. Thus, a mixture of 4500 g powdered $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$ and 956 g powdered MoO_3 was plasticized with 2450 g 12.86% HNO_3 , 199 g powdered CoCO_3 , 296 g 28% NH_4OH , and 250 g H_2O were added, and the mixture was extruded through holes of 1.6 mm diameter. The extrudate was dried 3 hours at 107 degrees and calcined at 399 and 593 degrees for 1 hour each time. Residual oil of 0.9866 specific weight and 3.69% S content was treated with H over this catalyst at 137 atm and 368-96 degrees for 16 hours to give a product of 0.9328 specific weight and 0.94% S content. (CAS) Abstr. No. CA75(6)38704u

378

Huthmann, E.

Dryers and Drying Methods for Highly Sensitive Bodies

1971 Documents

Keram. Z. 23(2), 84

In German. The paper describes the physical prerequisites for drying sensitive shaped bodies in air conditioned dryers. Recordings of the drying process in intermittent and tunnel dryers led to an air conditioned dryer which was newly developed for extremely difficult drying requirements. The simple design of the dryer and of the process, both applicable for intermittent and continuous kilns, offers new possibilities for artificial drying of bodies which so far have been dried in large rooms. This permits the design of production lines including the drying process. 4pp 7fig (BCA) Abstr. No. 3144/71

379

Kucher, E.

The Preparation of Heavy Clay Bodies Its Important Effect on the Quality of the Products--Methods and Equipment with Particular Reference to Roll Crushers

Silik. J. 10(1), 23

In German. The principles of roll crushers are analysed theoretically. The parameters of modern equipment discussed include the roll diameter and spacing, the rate of rotation and the angular momentum, the energy required and the fineness of grinding. Other practical considerations for obtaining uniform materials include hot preparation, ageing and control of moisture content. 11pp (BCA) Abstr. No. 2470/71

380

Limburg, K.

The Manufacture of Stoneware Pipes by Means of De-Airing Extruders

Interceram 20(1), 69

A brief review. (BCA) Abstr. No. 3658/71

381

Nagl, G.J.

Catalyst Composition and Hydrodesulfurization with an Extruded Composite Containing Alumina, a Group VI-B metal, and a Zinc Component

Patent No. U.S. US 3627674, 14 Dec, 1971, 5 pp.

USA

A coextruded catalyst is active for hydroprocessing reduced crude. Thus, a desulfurization catalyst was prepared by mixing 603 g ground Al_2O_3 and 40 cm^3 HNO_3 in 560 cm^3 H_2O . After allowing the mixture to stand 30 minutes, it was blended with a Zn-Mo solution prepared by dissolving 105.9 g H_2MoO_4 [85% MoO_3] in 120 cm^3 H_2O and 54 cm^3 28% NH_4OH and combining this with 109.5 g $\text{Zn}(\text{NO}_3)_2$ in 108 cm^3 H_2O and 120 cm^3 28% NH_4OH . The mixture was milled and aged 15 minutes. Excess liquid was vaporized until the mass could be extruded. The extrudates were dried 1 hour at 225 degrees F and calcined 3 hours at 1100 degrees F. The catalyst contained 4.5% Zn and 9.2% Mo. Catalyst activity was measured by desulfurizing reduced crude having a 10.2 degrees API gravity, 5.2% S, 2900 ppm N, 9, 1% heptane insoluble, 87 ppm metals, initial b.p. 590 degrees F, 30% b.p. 859 degrees F, and 55% b.p. 1030 degrees F. At 200 psig H, 0.8 liquid hourly space velocity, 5,000 ft^3 H/bbl, the catalyst had one third the deactivation rate of a conventional Ni-Mo catalyst. (CAS) Abstr. No. CA76(16):88249r

382

Nesby, C.W., and K.G. Huebner

Continuous Manufacture of Extruded Alumina

Patent No. S. African ZA 71/3178, 9 Dec, 1971, 13 pp.

In a continuous process for preparing Al_2O_3 bodies especially for catalyst supports, an alkali aluminate, an acidic reagent, and 0-20% SiO_2 (based on dry weight of Al_2O_3 are mixed in an aqueous medium at pH 5-12. The resultant precipitate is filtered and dried at 200-1000 degrees F. The recovered powder is washed, prewetted to form a slurry, and extruded into a pellet. The Al_2O_3 pellets produced had a surface area of 360 m^2/g , a total pore volume of 0.56 cm^3/g , and a crushing strength of 9.6 lb. Al_2O_3 or $\text{SiO}_2\text{-Al}_2\text{O}_3$ compounds can be produced which can be extruded to form pellets or tablets that can be

1971 Documents

used as catalysts or catalyst carriers in a fixed bed process for hydrotreating petroleum feedstocks. (CAS) Abstr. No. CA77(22):142088y

383

Piltz, G.

Technical Parameters of Drying Heavy-Clay Raw Materials

Ziegelindustrie (7), 294

In German. The drying properties of heavy-clay raw materials are to some extent due to particle size composition, but there is no ideal curve for this which is valid for general applications, mainly because of the combined action of some types of minerals, viz those less than 2 μ m. To reduce susceptibility to cracking the use of clay gel, fly ash, paper fibres or fine peat or sawdust in small quantities is recommended, but the degree of effectiveness of each material varies and must be tested in each case. Hot preparation of the body is also a good way of avoiding drying cracks. 4pp 5fig (BCA) Abstr. No. 72/1300

384

Rosemount Engineering Co.

Extruder Pressure Sensor

Patent No. Brit. GB 1,243,320, 18 Aug, 1971,

Fluid-controlled force rebalance pressure sensor for extruder pressure has a diaphragm, to be deflected by the pressure, situated at the end of a housing which jetlines a long stem adjacent the diaphragm. A movable wall remote from the diaphragm forms a chamber in the housing. A fluid passageway in the stem communicates with a

pressure-fluid source. A unitary force rebalance valve assembly within the stem includes a valve close to, and coupled to the diaphragm, whose movement under increased pressure adjusts the value so that the fluid pressure in the chamber changes. The assembly includes a rod which can move with the movable wall and transfer force from it through the valve to the diaphragm, to balance the pressure on the latter. (BCA) Abstr. No. 4117/71

385

Swiecki, Z.

The Flow of Plastic Body in the Screw Press

Szklo Ceram. 22(2), 47

In Polish. The relations between the construction of screw presses and the kinds of plastic bodies as well as the influence of the structure of bodies on the flow in the press are described. Changes in the flow of the body in the press are proposed, and a rheological equation is given. Modifications of the press construction are proposed in order to obtain a body of homogeneous structure. 5pp 7fig (BCA) Abstr. No. 3123/71

386

Taylor, W.A.

Structural Ceramics--an Introduction to Extrusion Techniques

J. Sci. Res. Council Jamaica 2(2), 47

(Abstract not available.) 8pp 4fig (BCA) Abstr. No. 72/2659

1972 Documents

387

Amsted Industries, Inc.

Injection Moulder for Vitrified Clay Pipe Fittings for Sewage and Water

Patent No. Brit. GB 1,281,385, 12 Jul, 1972.

Main mandrel and a secondary mandrel spaced from it are located in a die cavity, into which mouldable material may be forced, around and between the mandrels, until it conforms to the shape of the cavity and mandrels. T-, Y- and multi-branch pipes are moulded. (BCA) Abstr. No. 72/2681

388

Blume, A.J.

Extrusion Die Design

Am. Ceram. Soc. Bull. 51(2), 174

A brief note. 1p (BCA) Abstr. No. 72/1287

389

Bruch, C.A.

Extruding Fine Alumina Powders

Ceram. Age 88(6), 18

The results of various experiments in the extrusion of Linde A alumina powder with three organic binders are presented. 8pp 5fig (BCA) Abstr. No. 73/0153

390

Colgan, J.D.

Extruded Catalyst and Catalyst Supports

Patent No. U.S. US 3671463, 20 Jun, 1972, 5 pp. USA

A mixture of H_2O and xerogel whose maximum density of 0.6 is mulled for a maximum of 150 minutes to form a final dried mixture with minimum density = 0.7. The xerogel comprises a metal oxide including SiO_2 and 5 to 40 weight % soluble organic polymer with molecular weight of 100,000 or more. (CAS) Abstr. No. CA77(10):66675v

391

Cordoveanu, G.A.

Ceramic Dies for Extruders

Ziegelindustrie (11), 512

In German. An improved design is described, developed in Rumania, of extruder dies used for bricks and tiles, which markedly increases the resistance to wear of the dies. The latter are made from a model frame, the interior of which is covered with sheets of ceramic material (hardness 9 on Mohs scale). This material is made up of alumina-enriched refractory clay. The sheets made up with this body are biscuit-fired, machined, then fired, and fixed on the metal frame using steel pieces. The shape of the die differs from that of ordinary ones. Besides having good resistance to wear, the dies have a number of other advantages. Sixteen million roofing tiles have been extruded through one die, with abrasive wear less than 0.2 to 0.4 mm. (BCA) Abstr. No. 73/1335

392

Craven, R.E.

Brick Setting Systems Allied to Stiff Extrusion

Br. Ceram. Rev. (10), 31

A brief review of the stiff extrusion process, with details of the machinery required. 2pp (BCA) Abstr. No. 72/3311

393

Duncan, J.F., and K.J.D. MacKenzie

Clay Hardening

Patent No. Brit. GB 1,278,044, 14 Jun, 1972,

Clay (e.g., kaolinite) is hardened by applying an electric potential across it (preferably greater than 450 V ac or dc) whilst heating at greater than 850 degrees C optionally at reduced pressure. A greater degree of hardening is achieved in a shorter time than with heating alone. (BCA) Abstr. No. 72/2317

394

Ellistown Pipes, Ltd.

Extrusion Apparatus

Patent No. Brit. GB 1,281,562, 12 Jul, 1972,

1972 Documents

Comprises an annular extrusion orifice and a two part mould defining a mould cavity having two U-shaped end face parts to form the limbs of the junction. After moulding is complete the inner mould part is moved away from the orifice to allow the clay pipe to extrude and move the junction from the orifice. (BCA) Abstr. No. 72/2683

395

Ellistown Pipes, Ltd.

Extrusion of Clay Pipes

Patent No. Brit. GB 1,281,561, 12 Jul, 1972,

Equipment comprises a socket mould downstream of the extrusion die and a movable baffle upstream of the die, so that the flow of clay into the mould can be restricted on one side of the mould. The socket is asymmetrical and requires a greater volume of clay at one side. The baffle is used to ensure complete filling of the mould. (BCA) Abstr. No. 72/2682

396

Hungarian Standards Association

Testing of Untreated and Processed Plastic Ceramics

Hung. Stand. MSZ 12788/8

In Hungarian. (Abstract not available.) (BCA) Abstr. No. 75/0240

397

International Business Machines Corp.

Forming Ceramic Sheets

Patent No. Brit. GB 1,280,078, 5 Jul, 1972,

Viscous sol containing particulate ceramic material is extruded through an elongated opening. Then the extrudate is coagulated and severed. The sol dispersion is preferably weakly alkaline or non-alkaline, and the sol contains a linking agent having polyvalent cations or complexes, which is activated by passing the extrudate into strongly alkaline medium. The sol is preferably aqueous and contains mannose-galactose copolymer (Guar gum) as a particle binder. The coagulant is preferably separated from the extrusion opening by an immiscible liquid. Patterned

electrical conductors may be formed on the finished sheets for forming a multi-layer printed circuit module. (BCA) Abstr. No. 72/2675

398

Kobayashi, T., et al.

Rheological Properties of Plastic Clay Body. An Examination on the Astbury's Cyclic Torsion Test Method

J. Ceram. Soc. Jpn. 80(2), 64

In Japanese. The rheological properties of plastic clay body were studied by Astbury's cyclic torsion test method. By analyzing the hysteresis loops of the stress-strain curves, the following results were obtained: (1) The remanent strain depended markedly on the maximum strain. (2) The coercive force and the maximum stress much decreased on the increase of the moisture content. (3) The ratio of the coercive force to the maximum stress was constant regardless of experimental conditions. (4) The energy absorbed during the cycle was directly proportional to the maximum strain and was reduced with increasing moisture content. (5) If the torsional strain amplitude and the frequency of sinusoidal oscillation were taken as the same condition, the ratio of energy lost during one cycle to the one for perfectly plastic body was equal to the ratio of the coercive force to the maximum stress, which was constant, irrespective of experimental conditions. (BCA) Abstr. No. 72/2922

399

National Forge Co.

Isostatic Press for Ceramic Spark Plug Insulators

Patent No. Brit. GB 1,281,740, 12 Jul, 1972,

Press has an elastomeric container in a fluid pressure chamber. A cavity in the container receives powder to be compressed and moulded, and the container body is mounted in a fixed position in the chamber. A plug extends through the body and to the cavity; when removed, it forms a passage for powder delivery to the cavity. A second plug extends similarly; the moulded powder article is supported on it after compression. The two

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plugs can be removed from, and repositioned in, the body. (BCA) Abstr. No. 72/2684

400

Ravaglioli, A., and G. Vecchi

Outline of Drying Procedures in the Ceramic Industry and Main Drying Features of Raw Materials and Ceramic Bodies

Ceramurgia 2(1), 22

In Italian. The dehydration of ceramic mixtures in a plastic state at 0 to 100 degrees C is a fairly critical operation as it involves both a water loss and shrinkage. This paper examines the basic factors involved and describes briefly the various drying methods, with special reference to those techniques which permit a proper dehydration of the parts just formed and of the raw materials employed in a very short time. A brief description is given of some methods recommended for recording the behaviour of clay mixtures during drying by means of the Adamel "Barelattographe". Some typical clays and argillaceous rocks of different origins are examined, and their chemical nature and behaviour on drying are described. Finally, the results of studies on d'Arvor kaolinite in France are reported, namely: the need to subject mixtures to vibrations in order to eliminate possible strain deriving from the drying dynamics; the importance of the orientation of particles; the action of leaning agents such as grog or silica. 9pp 23fig 9tab (BCA) Abstr. No. 73/0725

401

Roget, M.

The Drying of Ceramic Products

Ind. Ceram. (648), 83

In French. After a brief review of some interesting theoretical ideas of drying, the author studies the factors concerning the drying time: dimensions or dispersion of a product, relative velocity of the air, temperature and humidity of the air. Then he studies the physical behaviour of the products during drying and notably the stresses due to frictional forces and capillary forces. Cer-

tain physical characteristics of the products influence the drying: Specific surface, ratio of porosity, particle-size distribution desorption curves, etc. Finally, in the last part, he gives different examples of dryers: tunnel dryers with inverted transverse flow, dryers on superposed covers and by forced convection, double-layer dryers, pneumatic dryers, fluidized-bed dryers. 6pp 11fig (BCA) Abstr. No. 72/1559

402

Rudakov, V.N., et al.

Study of the Structure of Moulding Porcelain Body by Radiointroscopy

Glass Ceram. (Engl. Transl.) 29(10), 674

The study of extrusion faults using cm-wave radiography is described. 3pp 5fig (BCA) Abstr. No. 74/1936

403

Sanford, R.A., J. Mooi, and E.S. Rogers

Extruded Alumina Catalyst Supports

Patent No. U.S. US 3679605, 25 Jul, 1972, 3 pp.

A method of preparing extruded, gel-type alumina catalyst supports is disclosed. The method involves mixing crystalline alumina hydrate and approximately 2-25 parts by weight of low density polyethylene/100 parts of alumina and an extrudable amount of H₂O extruding and calcining the mixture in a molecular O-containing gas to substantially burn away the polyethylene and form a support. Additionally, approximately 0.5-3 weight % of starch and or methyl cellulose may be included in the mixture prior to extrusion and calcination. These latter materials are also burned out of the support during calcination. (CAS) Abstr. No. CA77(26):169287z

404

Schlegel, D.

The Rheology of Plastic Ceramic Bodies

Ind. Ceram. (647), 37

In French. In plastic ceramic bodies subjected to low shear stresses in a Couette-type flow there occur discontinuous deformation processes and

1972 Documents

lamination phenomena. If, on the other hand, the mean shear rate is high, the material behaves as a homogeneous continuum. In this case the shear stresses can be determined from the values measured taking into account the slipping along walls. It appears that slipping must not be ignored even with heavily profiled walls. Shear stress functions of plastic ceramic bodies are non-linear. 4pp 8fig 1tab (BCA) Abstr. No. 72/1838

405

Schuster, P., E. Gugel, and H.W. Hennicke

Investigations on Texture and Properties of Stoneware. Pt. 2. Formation and Mode of Occurrence of Mullite in a Stoneware Body

Ber. Dtsch. Keram. Ges. 49(9), 291

In German. Electron and x-ray investigations and solution with HF show that stoneware bodies contain, in addition to the known primary and secondary mullite phases, yet another phase forming as a result of thermal dissociation of illite. In the electron-microscope this appears as an extremely fine mixture of primary mullite and liquid phase. Investigations were carried out to study the reaction kinetics of mullite formation between 1050 and 1150 degrees C, and calculations gave reaction rate constants of 0.06 to 0.87 (h^{-1}). Owing to the accelerating effect of the interlayer cations and the large specific surface of illitic clays, the experimental activation energy was calculated to be 45 kcal/mol which is rather low in comparison to porcelain bodies. Homogeneous distribution of the alkali ions is the cause of the early vitrification of stoneware, while the intimate mixing of the liquid phase and mullite is responsible for the wide vitrification range. 4pp 7fig 1tab (BCA) Abstr. No. 73/1160

406

Societe Generale De Fonderie

Internally Spray Coating Pipe

Patent No. Brit. GB 1,264,354, 23 Feb, 1972,

Waste-pipe is spray coated internally as the pipe is extruded from a die, preferably clay mixture is

extruded onto a table which forms an enlarged end and moves down with the formed pipe and actuates a valve controlling flow of coating material to nozzle arranged adjacent to the die. When valve is closed a wire cutter separates a length of formed pipe. (BCA) Abstr. No. 72/1046

407

Suddeutsche Kalkstic-Stoffwerk AG

Gypsum Composition for Ceramic Moulds

Patent No. Brit. GB 1,281,053, 12 Jul, 1972,

A mixture of 0.03-0.15% NaK tartrate, 2-8% Ca hydrogen phosphate, accelerator, a hardener and a retarder, and balance alpha- and/or beta-hemihydrate of gypsum, is diluted with 24-35 ml/100 g of a solution (I) including 2-25 ml of a 20% aqueous solution of a modified melamine resin. Solution (I) may also include phenol resin and/or urea resin, as aqueous solution or solid. Composition may also include a pore-forming agent and a CMC and/or a methyl cellulose. Moulds formed from the composition have greater mechanical strength than conventional plaster moulds. (BCA) Abstr. No. 72/2679

408

Vickers, Ltd.

Run-Out Trough for Extruder

Patent No. Brit. GB 1,274,236, 17 May, 1972,

Extendable portion can move out from a retracted initial position as the trough moves, to carry an extrusion away from the press, thus lengthening the trough's supporting surface, to support the last end part to be extruded. (BCA) Abstr. No. 72/1955

409

Watanabe, N.

Relationships Between the Plasticity and the Fundamental Parameters of White-ware Bodies

J. Ceram. Soc. Jpn. 80(7), 259

In Japanese. The plasticity index was determined by measuring the wet module of rupture and maximum deformation. When the funda-

1972 Documents

mental parameters, wet strength coefficient, and the plasticity index of the body were known, the maximum deformation at the moisture content of shaping operations could be calculated. Variation of plasticity index due to ageing, amount of deflocculant, and clay content was examined. 4pp 8fig 1tab (BCA) Abstr. No. 73/0243

410

Worrall, W.E., and R.A. Khan

An Extrusion Method of Assessing the Plasticity of Clays

Trans. J. Br. Ceram. Soc. 71(6), 159

A simple extrusion apparatus is described. The values determined put the various clays in an order approximately in accordance with that generally accepted. Investigations showed that the plasticity indices obtained were independent of moisture content over a wide range. 3pp 3fig 1tab (BCA) Abstr. No. 73/0905

1973 Documents

411

An Extrusion Method of Assessing the Plasticity of Clays

Ceram. Inf. 8(9), 512

In Italian. The values determined put the various clays in an order approximately in accordance with that generally accepted. (BCA) Abstr. No. 74/0581

412

Albenque, M., and M. Fernandez

A Study of Additives to Improve the Drying of Clays

Terre Cuite (58), 5

In French. The effects of a number of organic additives on the properties and drying behaviour of brick clays were studied. 13pp 1fig (BCA) Abstr. No. 74/1696

413

Ciontea, N.

Consideration on the Single-Firing of Domestic Porcelain

Vincenzini, P.(ed.), Single-Firing and Automation. Proc. 2nd Internat. Meeting on Modern Ceramic Technol. Faenza: Centro de Recherche Tecnologiche per la Ceramica e Ceramurgia, 1973, p. 52

The paper presents some results concerning improvements to the dry strength of domestic porcelain ware with a view to future mechanized glazing and some aspects of the firing conditions of single-fired products and their quality. 3pp (BCA) Abstr. No. 74/1713

414

Coudamy, J.

Drying Developments Since 1955

Ind. Ceram. (662), 343

In French. Examples of dryers used in 1955 on the one hand and in 1970 on the other in the production of tiles and bricks, plates, flower pots, and tiles, show that the development has been hot air, infra-red and high-frequency drying. 5pp 7fig (BCA) Abstr. No. 73/3016

415

Dangler, E.W.

Comparative Rheological Behaviour of Suspended Clays with Varying Ionic Composition

Diss. Abstr. Int. 34(6), 2403-B

Thesis: Univ. Hawaii, 1973

(Abstract not available.) Order No. 73-28,798. 253pp (BCA) Abstr. No. 75/2942

416

Fuchs GmbH

Extrusion Die Assembly

Patent No. Brit. GB 1,340,122, 12 Dec, 1973,

Wear- and temperature-resistant die insert for preheated billets of titanium alloys is held inside a die holder of an extrusion press between a tapered entry sleeve bearing against a billet receiver and a ceramic insert of low conductivity. A surface of the ceramic insert adjacent the die insert is provided with electric heating for the die insert. (BCA) Abstr. No. 74/1258

417

Grunewald, H.

Rheological Properties of Screen Printing Media and Pastes for the Decoration of Tiles

Sprechsaal 106(21), 823

In German. The flow properties of a typical screen printing medium were determined. The influences of the viscosity of the medium and screen-printing paste on production procedures are discussed. 3pp 7fig (BCA) Abstr. No. 74/0702

418

Guella, M.S., and D. Rosignoli

New Method of Studying Raw Materials and Chemical Additives in Manufacturing Technology

Ceram. Inf. 7(11), 626

Also Indust. Ital. Later. 27(1/2), 5

In Italian. The article is chiefly concerned with the properties of binders. 5pp 9fig 2tab (BCA) Abstr. No. 74/0674

1973 Documents

419

Kessel, E.

Construction Characteristics of Modern Extruders for Stoneware Pipes

Keram. Z. 25(11), 616

In German. The design requirements for extruders for 300-600 mm pipes are discussed. 2pp 3fig (BCA) Abstr. No. 74/0682

420

Kuch, F.

Quality Surveillance and Control of the Clays of Westerwald

Keram. Z. 25(9), 465

In German. A brief description of a plant where the properties of the final clay are maintained by the blending of different raw clays. 2pp 6fig (BCA) Abstr. No. 74/0675

421

Leach, B.E., G.G. Hritz, and D.J. Royer

Extruded Aluminum Oxide

Patent No. Ger. Offen. DE 2237861, 22 Feb, 1973; U.S. US Appl. 168420, 2 Aug, 1971, 24 pp.

In German. A highly porous title product of low density and very low shrinkage for use as a catalyst or catalyst carrier is obtained by mixing a specially prepared, finely divided Al_2O_3 with water to give a putty-like mixture and extruding the mixture. The Al_2O_3 is prepared by hydrolysis of Al alkylate followed by separation of hydrated Al_2O_3 from the organic portion, mixing of the former with an organic solvent such as Me_2CO or a C_{1-4} aliphatic alcohol, and drying of the resultant aqueous Al_2O_3 -solvent mixture to give an Al_2O_3 having a loose bulk density of 0.13-0.56 g/cm³, a pore volume of 0.8-2.5 cm³/g, a specific surface area of 250-500 m²/g, and an Al_2O_3 content greater than 77%. The water may contain less than or equal to 2% of an acid of alkaline component. Good results are obtained when the volume of the added water is equal to the pore volume of the Al_2O_3 to be extruded. The resulting extruded Al_2O_3 after drying at 121 degrees for 6 hours has the respective values 0.24-0.56, 0.8-2.0, and 150-

350 at a diameter of 0.08-0.635 cm. Thus, an aqueous Al_2O_3 suspension obtained by hydrolysis of Ziegler Al alkylates with water was contacted with BuOH and dried to a product with the respective parameters 0.176, 1.99 and 283, which was mixed with H_2O to give a homogeneous mass. This was extruded and dried 2 hours at 121 degrees to give a title product with the respective parameters 0.32-0.38, 1.16 and 268. The amounts used were 500 g Al_2O_3 and 980 g H_2O , the Al_2O_3 content 90.4%. (CAS) Abstr. No. CA79(4):21080x

422

Metallwerk Plansee AG and Co. KG

Extrusion Dies

Patent No. Brit. GB 1,308,752, 7 Mar, 1973,

These dies are well-workable and have no tendency of being welded to extruded material. They comprise 40-98 vol % finely divided Mo and/or W and the remainder an oxide ceramic, preferably spinel stable at up to 1700 degrees C. (BCA) Abstr. No. 73/2236

423

Nesby, C.W., and K.G. Huebner

Continuous Manufacture of Extruded Alumina Structures

Patent No. Fr. Demande FR 2139715, 16 Feb, 1973, 9 pp.

In French. An aqueous solution of an alkali metal aluminate or a mixture thereof with less than or equal to 20% of an alkali metal silicate is treated with an acid material at pH 5-12 to precipitate Al_2O_3 or an Al_2O_3 - SiO_2 mixture. The precipitate is filtered to a solids content of 10-20 weight % based on Al_2O_3 , dried at 93-538 degrees and recovered. The powder is washed, prewetted with water to form a suspension which is extruded as a strip. A suitable acid material is aldonic acid. The product is suitable as a catalyst support, especially in the petroleum refinery industry. (CAS) Abstr. No. CA79(16):94137f

424

Pels Leusden, C.O.

1973 Documents

Cause of Lamination and Methods of Control

Ziegelindustrie (12), 438

In German. The behaviour of clay particles during plastic deformation is followed by means of models and by the strength determination of ceramic bodies in various directions. Lamination is caused by inhomogeneous flow and segregation phenomena and also by the loosening of the structure after the shaping process. Examples show how lamination may be checked according to its cause. 11pp 28fig (BCA) Abstr. No. 74/1384

425

Rawdon, Ltd.

Extruder for Clay Pipes

Patent No. Brit. GB 1,330,469, 19 Sep, 1973,

Core is supported in the die, extrusion passage by spider arms extending across the passage. A rotary cutter blade at the die outlet is advanceable and retractable transversely of the rotation axis, to cut transversely a tube extruded from the die, and is driven by the fluid or electric motor, the power supply line(s) to which are led into the core through one or more of the arms. (BCA) Abstr. No. 74/0300

426

Rawdon, Ltd.

Extrusion Press Control

Patent No. Brit. GB 1,313,854, 18 Apr, 1973,

An extrusion press has a control circuit which produces pulses in proportion to the length of the extruded product and cuts off the power supply when a pulse counter determines that the product has reached a predetermined length. The press is used particularly to produce clay pipes, ribbons or blocks, although the technique is equally applicable to metal and plastics extrusion. The counter may have multiple channels for controlling formation of flanges, grooves, or other features at preset pulse counts. (BCA) Abstr. No. 73/2446

427

Ries, H.B.

Preparation of Fine Ceramic Bodies: A Counter-Current Intensive Mixer With High-Energy Rotor

Interceram 22(3), 207

In English and German. The mixing requirements, in particular the specific mixing energy, for modern ceramic processes are discussed. A design for a counter-current intensive mixer with a high energy rotor is described. (BCA) Abstr. No. 74/0676

428

Schultheiss, I.F.

Operational Experience with Water Content Control Installations

Ziegelindustrie 26(10), 372

In German. The development and operation of a system for the control of water content during clay preparation is described. 2pp 1fig (BCA) Abstr. No. 74/0677

429

Steventon, J. and Sons, Ltd.

Casting Ceramics in Slip Form

Patent No. Brit. GB 1,333,707, 17 Oct, 1973,

In a casting technique, after filling a mould, e.g., of plaster of Paris, with ceramic slip and allowing a skin to form adjacent the mould walls, surplus slip is drained from the cavity defined by the skin, air simultaneously being admitted to the cavity at a point below the top of the mould to avoid establishment of reduced pressure in the cavity such as might cause the skin to lift from the walls. The air may be atmospheric or higher pressure. (BCA) Abstr. No. 74/0307

430

Tesla Narodni Podnik

Forming and Drying Ceramics During Extrusion From a Press

Patent No. Brit. GB 1,341,812, 23 Dec, 1973,

1973 Documents

The material is passed through a heating chamber where it is electrically heated so that a continued stream of the extruded mass emerges at 40-90 degrees C and, after emerging from the press nozzle orifice, it is cut into individual extrudates while still in this temperature range. After being cut, and before cooling below 35 degrees C, the extrudates are dried in a gas stream heated to 60-250 degrees C. (BCA) Abstr. No. 74/1050

431

Tesla, N.P.

Ceramics Extrusion Press

Patent No. Brit. GB 1,334,968, 24 Oct, 1973,

The extruder has a material heating chamber of the flow type with elongate electrodes against the curvature of the internal wall of the chamber. Extending from the mounting part, radially towards the centre of the chamber, is a second electrode part. The electrodes can be delta-connected to a 3-phase supply, and three such electrodes may surround a conductive mandrel at the chamber centre. (BCA) Abstr. No. 74/0309

432

Thomas, J.P.F., J.L.E. Tranchant, and J.A. Ramond

Double-Base Powdered Explosive Compositions

Patent No. Fr. FR 2163816, 31 Aug, 1973, 7 pp.
France

In French. Di-Et phthalate is added to mixtures of nitrocellulose and nitroglycerin to increase the plasticity. The resulting explosives can be continuously extruded at 75. A satisfactory composition contains nitrocellulose (11.7% N) 33, nitrocellulose (12.5% N) 22.5, nitroglycerin 34.5, 2-nitrodiphenylamine 2, basic Pb stearate 2.5, di-Et phthalate 6, K cryolite 0.6, Cu chromite 1, and C_2H_2 black 0.6%. The combustion rate varies from 5.3 mm/sec for a composition containing no C_2H_2 black to 24.2 mm/sec for 0.8% C_2H_2 black. Above this concentration the combustion rate levels off. The elastic extensions at 20 and 51 degrees are 3.1 and 8.8%, respectively, compared with 2.6 and 2.3% and 2.4 and 3.3% for two conventional compounds. The elongations at rupture at 51 degrees are 26, 9.4 and 18%, respectively, for the new composition and the conventional ones, and the extrusion pressures at 75 degrees are 110 bars for the new composition and 112 bars for a conventional one. (CAS) Abstr. No. CA80(12):61724n

433

Von Reumann, O.

The Origin and Remedy of Faults in Ceramics, Especially in Porcelain Manufacture

Glas-Email-Keramo-Tech. 24(9), 297

In German. Some faults, with special regard to porcelain manufacture, are described, their sources indicated, and the measures to avoid them noted. The statements are intended for works managers. (BCA) Abstr. No. 74/0124

1974 Documents

434

Extrusion Machine Survey

Clayworker 83(984), 10

A comprehensive international review of equipment now available for clay extrusion is presented. Included are manufacturers of equipment in the U.K., Italy, West Germany and the USA. 7pp (BCA) Abstr. No. 74/3453

435

Angenitskaya, R.B.

A Study of the Kinetics and Mechanism of the Drying Process in Ceramic Materials

Glass Ceram. (Engl. Transl.) 31(12), 864

(Abstract not available.) 3pp 1fig (BCA) Abstr. No. 76/1622

436

Berger, D.

Drying Behaviour of Hygroscopic Capillary Porous Solids Under Non-Isothermal Drying Conditions

Diss. Abstr. Int. 35(2), 797-B

Thesis: Univ. of Waterloo (Canada), 1973

Available for consultation at the Univ. of Waterloo Library. (BCA) Abstr. No. 75/2662

437

Bigg, D., and S. Middleman

Mixing in a Screw Extruder. A Model for Residence Time Distribution and Strain

Ind. Eng. Chem. Fundam. 13(1), 66

A mathematical model for the two-dimensional flow field of power-law fluids in a screw extruder is developed and used to calculate screw characteristics, residence time distributions, delay times, and a weighted average total strain of fluid elements. The dependence of these variables on fluid properties and operating variables is presented and discussed. Experiments were performed with Newtonian and strongly non-Newtonian fluids which are in very good agreement with the predictions of the theory. 6pp 17fig 1tab (BCA) Abstr. No. 74/1992

438

Dorst, M.

Automatic Installation for Body Preparation in the Ceramic Industry

Ind. Ceram. (673), 368

In French. Two principal systems of preparation are described. For very large installations, intermediate silos are used on a daily basis for each pre-ground constituent, fed by automatic conveyor belts then weighed electronically and loaded automatically from the mills or downstream mixers, with centralized control. For small and medium sized installations, weighing is carried out in a linear proportioner, set on dynamometer gauges, and which can be loaded using a mobile loader. 3pp (BCA) Abstr. No. 74/3436

439

Interoptik Handelanstalt

Multilayer Extrusion

Patent No. Brit. GB 1,374,858, 20 Nov, 1974,

Tiles are made by using a brick extruder to extrude a series of superposed layers of clay, imparting uniform speed to layers at the extruder outlet, placing an impermeable coating, preferably of Al, oiled paper or plastic sheet on upper and lower surfaces of the layers issuing from the outlet, introducing between adjacent layers at the outlet a particulate product, preferably powdered polyvinylacetate with an appropriate amount of polyvinylalcohol, ensuring the separation and causing partial adherence and removable by heat, cutting the layers, baking and separating. (BCA) Abstr. No. 75/0585

440

Joger, A.

Central Body Preparation

Silikattechnik 25(2), 52

In German. A literature review. 3pp 6fig (BCA) Abstr. No. 74/2439

441

Larsson, H.F.

1974 Documents

The Effect of Vibrations on Sedimentation Processes

Diss. Abstr. Int. 35(3), 1245-B

Thesis: Chalmers University of Technol. (Sweden), 1972

The settling of all suspensions studied was enhanced by low frequency vibrations and ultrasonic vibrations, if the concentration of suspended material was high. Gamma radiation produced flocculation in sewage sludge. Order No. 74-20,117. 178pp (BCA) Abstr. No. 75/2649

442

Limburg, G.

Clay Preparing System for Ceramic/Brick Industries

Patent No. Brit. GB 1,363,283, 14 Aug, 1974,

The system includes a control circuit to control the water content of the clay by means of either the clay or water feeders, the controlling parameter being the current fed into the control circuit. A thermo converter takes the current fed into the circuit to measure the actual value of the water content, the incoming ac signal being converted to a dc voltage. Preferably it is connected by an adjustable resistor. The control circuit also includes a range controller, and the water feeder has a valved regulator. (BCA) Abstr. No. 74/3072

443

Lyng, S., and K. Gamlem

Anorthosite as a Ceramic Raw Material. I. Extrudable and Castable Electrical Porcelain and Vitreous China

Trans. J. Br. Ceram. Soc. 73(5), 133-7

Norway

Anorthosite from 3 different locations in Norway were used as a ceramic flux in electrical porcelain containing less than or equal to 36% Al_2O_3 and vitreous china. Dense products using anorthosite as a flux were difficult to obtain when firing cycles of greater than 24 hours were used. For short firing cycles, anorthosite had good fluxing power. For the shorter firing cycles anorthosite ceramics had less than or equal to 30% lower firing defor-

mation, a broad firing range, and higher density and strength than the corresponding bodies containing nepheline syenite. In addition to the usual crystalline phases ($\alpha\text{-Al}_2\text{O}_3$, quartz, and mullite) a considerable amount of crystalline feldspar was present. Higher thixotropy and viscosity of ceramic slips containing anorthosite could be counteracted with slightly higher soda ash and water glass additions than usual. (CAS) Abstr. No. CA82(4):20987y

444

Mattyasovszky Zsolnay, T., and P. Balint

The Influence of the Methods of Preparation on the Properties of Clay Bodies and Green Ware

Interceram 23(2), 128

In German and English. Two Hungarian brick clays were investigated. The grade of grinding, amount of working water and storage played important roles in determining properties of the clay bodies and green ware. 3pp 5fig 2tab (BCA) Abstr. No. 74/3435

445

Mostetzky, H.

Two Models for Evaluation of the Hydroplasticity of Ceramic Bodies

Tonind. Ztg. 98(11), 287

In German. The difference in plasticity of ceramic bodies is characterized by means of two balls and two circular discs as very different elementary models for hydroplasticity. Especially the influence of the water content was tested. The combination of properties from various fundamental elements are in good agreement with the observed plasticity. 2pp 4fig (BCA) Abstr. No. 75/1123

446

Ol'Khovskii, I.A., and V.V. Nekrasov

Electroosmotic Dehydration of High-Chamotte Compounds

Refractories 15(6), 349

1974 Documents

This is developed for drying large blocks, to replace convective drying which is slow and required large floor space. Thus, the drying time of a 500 kg high-chamotte product was reduced from 200-250 hours to 14-15 hours. 4pp 4fig 1tab (BCA) Abstr. No. 76/1060

447

Papen, E.L.J., H.D.B. Raes, and G. Deplace

Development and Application of the Iso-static Pressing Process in the Refractories, Ceramic and Electrical Porcelain Industries

Interceram 23(3), 204

Also Keram. Z. 26(2), 86

In German and English. The general technique is described and pressing methods divided into type of rubber mould and pressing fluid used, and operating temperature. Pressing plant components and the influence of certain parameters in the process, including mechanism of powder compaction, are discussed. Practical applications, such as the pressing of refractory products, sanitaryware and ceramic components, are also mentioned. 6pp 13fig 1tab (BCA) Abstr. No. 74/3454

448

Richter, W.

Up-To-Date Technology in Stoneware Pipe Production

Keram. Z. 26(11), 638

In German. The paper is chiefly concerned with highly mechanized systems for handling and setting pipes. 4pp 19fig (BCA) Abstr. No. 75/1012

449

Werkmeister, G.

Mollier's H,X Diagram for Moist Air According to the SI (Metre-Kilogramme-Second) System of Units

Ziegelindustrie (7), 298

In German. (Abstract not available.) 6pp 10fig (BCA) Abstr. No. 74/3371

450

Ziegenhain, W.C., and G.K. Madderra

Stabilized Alpha-Alumina Monohydrate Extrudates

Patent No. Def. Publ., U. S. Pat. Off. T US 929001, 3 Dec, 1974, 10 pp.

USA

Dried Al_2O_3 shapes prepared by usual methods for use as catalyst supports often crack and disintegrate when dipped in aqueous solutions to incorporate catalyst metals. The shapes are stabilized against such disintegration by gradually adding H_2O , e.g., by steaming until greater or equal to 75% of the pore volume is filled. Excess H_2O is drained off and the shapes are dipped in an aqueous solution of the catalyst metal. (CAS) Abstr. No. CA84(14):96081k

451

Zienkiewicz, O.C., and P.N. Godbole

Flow of Plastic and Visco-Plastic Solids with Special Reference to Extrusion and Forming Processes

Int. J. Numer. Methods Eng. 8(1), 3

An effective numerical treatment of non-Newtonian flow by the finite element method is indicated and is illustrated by examples of an extrusion process for which approximate slip line solutions are known. 14pp 11fig (BCA) Abstr. No. 74/1673

1975 Documents

452

Measurement and Control of Plasticity in Ceramic Works

Silik. J. 14(3), 97

In German. Both the power consumption of the processing machine and the pressure in the spacer of the pugmill can be used as measures of plasticity and water content. Methods of controlling the latter automatically are described, and the diagram of a plasticity control installation is presented. 8pp (BCA) Abstr. No. 76/0995

453

Conway, J.E.

Extruded Catalyst Composition

Patent No. U.S. US 3894966, 15 Jul, 1975, 3 pp. USA

A dry mixture consisting of the following fines: Group VIB metal compound (preferably Mo) 4 to 30, Group VIII metal compound (preferably Co) 1 to 10 weight % and remainder $\alpha\text{-Al}_2\text{O}_3\cdot\text{H}_2\text{O}$ is mulled with acid to form a plastic dough extrudable at less than 500 psig. After drying and calcining, the catalyst is suitable for hydrodesulfurization of petroleum fractions. (CAS) Abstr. No. CA83(18): 153200d

454

Conway, J.E., and M. Raterman

Extruded Catalyst Particles

Patent No. Ger. Offen. DE 2511967, 9 Oct, 1975, 13 pp.

USA

In German. A method is described for the preparation of extruded catalysts which led to an increase of the macropore volume (greater than 100 angstroms) of a resistant inorganic oxide catalyst or support. Thus, for the preparation of extruded catalyst particles, finely ground $\alpha\text{-Al}_2\text{O}_3\cdot\text{H}_2\text{O}$ was mixed with 2% Me Cellulose as a binder and lubricant. A sufficient amount of H_2O as a peptizing agent was added to form a smooth and soft extrudable paste. The aqueous solution contained a linear primary alcohol polyether as a surfactant. This mixture was

kneaded and mulled 30 minutes and then extruded at 10.5 kg/cm^2 , dried, and calcined at 650 degrees. The catalyst can be used for hydrotreating crude petroleum or distillate oil. (CAS) Abstr. No. CA83(26):209821b

455

Du Pont de Nemours, E.I. and Co., Inc.

Process for Preparing Alumina Yarns

Patent No. Brit. GB 1,414,854, 19 Nov, 1975,

Refractory oxide yarns, especially polycrystalline alumina multifilament yarns, are produced continuously by extruding a mixture of solid particles in an aqueous phase, the particles being more than 80% alumina and the aqueous phase containing dissolved basic Al salts precursors of alumina. The proportion of solid to precursor is such that 35-75% total oxide is provided by the solid particles, more than 80% of the oxide being alumina. The particles are less than 5 μm with more than 98% less than 3 μm (equivalent spherical diameter). No dimension is less than 0.0054 μm (measured by electron micrograph). The extrusion is through orifices to give a multifilament yarn containing 30-60% volatile material which is subsequently removed by heating. The precursors are converted to oxide by winding onto a collapsible bobbin to form a shrinkable, continuous filament yarn package which is heated to 300-1400 degrees C until volatiles are reduced to less than 11%. (BCA) Abstr. No. 76/0433

456

Handle, F.

Perspectives in Ceramic Shaping Technology

Interceram 24(4), 262

The paper briefly discusses the relationships between extrusion in theory and practice. 4pp 4fig (BCA) Abstr. No. 76/2582

457

Hohmann, H.

Development of the Conception of the Drying Technique in Building Ceramics and Heavy Clay Industry

1975 Documents

Silikattechnik 26(4), 111

In German. (Abstract not available.) 3pp 2tab
(BCA) Abstr. No. 76/0285

458

Kermaikmaschinen mbH and Co. KG, Ges. Fur
Screw Extruder for Ceramic Materials

Patent No. Brit. GB 1,389,270, 3 Apr, 1975,

Ceramic materials are extruded by a screw mounted on a driven shaft, the screw including screw sections for compressing and conveying ceramic material to an extrusion nozzle. The screw sections are mounted so as to rotate with the shaft but to be axially movable with respect thereto during extrusion, the screw being supported independently of the shaft by a thrust bearing against axial pressure generated during extrusion. Preferably a bush is disposed between the thrust bearing and the screw section adjacent thereto, the bush being an interference fit on the shaft and having one face sized to match a hub portion of a screw section in contact therewith and another face for contacting the thrust bearing. (BCA) Abstr. No. 75/1695

459

Knobeloch, G., and F. Soukup

Measures for Reducing the Energy Requirements in the Building and Heavy Clay Industries

Baustoffindustrie, Aug. A 18(6), 27

In German. The main recommendations are: to use mixed air dryer with internal heating and reversible airflow and then to fire in a short tunnel kiln. 3pp (BCA) Abstr. No. 76/2607

460

Leach, B.E., and G.G. Hritz

Extruding Alumina

Patent No. U.S. US 3917808, 4 Nov, 1975, 5 pp.

In preparing extruded Al_2O_3 shapes for catalyst support, commercial $\alpha\text{-Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$ is mixed with a monoprotic acid, e.g., AcOH , and then with a polyprotic acid, e.g., citric acid. Sufficient H_2O is added to form a paste and the mixture is

extruded, followed by drying at 240 degrees F and calcining at 900 degrees F. The product contains 80-100% Al_2O_3 , has a bulk density of 10-35 lb/ft^3 , and is stable in H_2O . (CAS) Abstr. No. CA84(12):80375y

461

Mewis, J.

On the Need for Multi-Parameter Theories in the Analysis of Thixotropic Behaviour

J. Phys. D: Appl. Phys. 8(12), L148

At present most thixotropic theories use a single parameter to describe the reversible structural changes caused by shearing. The need for a more general theory has been investigated and argued against recently. On the basis of new experimental evidence it is shown here that, under certain conditions, physical phenomena occur which require a multiparameter model for their explanation. Viscoelastic and dielectric measurements are discussed that prove a difference in structure between recovery under shear and recovery at rest. The data include both systems with intermolecular and with interparticulate structures. The difference in structure can be explained on the basis of a three-dimensional network which develops after cessation of flow, whereas under shear the structure consists usually of isolated elements of varying size and shape. This picture is in agreement with the measured spectra. Finally a simple experiment is suggested which allows one to estimate the necessity for a multiparameter description of a given thixotropic system. 4pp 2fig (BCA) Abstr. No. 76/0481

462

Orlova, I.G., Ya.M. Grinberg, and I.S. Kainarskii

Rheological Properties and Pressability of Thermoplasticized Refractory Masses

Inorg. Mater. (Engl. Transl.) 11(1), 124

To obtain by hot-pressing refractory artifacts with a porosity of less than 5%, the thermoplastic composition must have a static yield point at the pressing temperature which is not less than $(30-40) \times 10^6 \text{ dyn/cm}^2$, and the sum of plastic and

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slow elastic deformations must not be less than 90-95% with the condition that the pressing pressure exceeds the yield point by a factor of at least 1.5-2. The duration of holding of the pressure must exceed the relaxation period by a factor of at least two. 4pp 4fig (BCA) Abstr. No. 75/3343

463

Rigaud, J.

Drying of Ceramic Compositions

Ind. Ceram. (684), 321, (685), 391

In French. Various theories of drying of clays are considered. Anomalies in the drying shrinkage curve are discussed, and the effects of drying shrinkage curves to predict optimum drying schedules are noted. Chemical changes during drying and the development of texture are considered. (BCA) Abstr. No. 76/2256

464

Riley, K.L., W.T. House, and J.E. Hofmann

Hydrotreating Catalyst

Patent No. U.S. US 3905916, 16 Sep, 1975, 6 pp. USA

Hydrotreating catalysts containing approximately 4% CoO [1307-96-6], 13% MoO₃ [1313-27-5], and 2-4% SiO₂ with the balance Al₂O₃ were prepared by procedures that involved either extrusion or conventional spray drying. The extruded catalyst differed from the spray-dried catalyst in having increased surface area in pores of 30-80 angstroms diameter and higher activity in the hydrodesulfurization of petroleum residual fractions at 600-850 degrees F and 500-250 psig. (CAS) Abstr. No. CA84(2):7451r

465

Safronova, I.P., E.V. Degtyareva, and I.S. Kainarskii

The Rheological and Technological Properties of Silicon Carbide Slips and Castings Containing Added Silicon and Clay

Refractories 16(1/2), 45

For producing silicon carbide refractories by slip casting the optimum pH range is 8.5-11 whether the slip contains or does not contain added clay or silicon, although the kinetic stability of the slip is decreased in this case. Added clay or silicon increases the viscosity slightly and reduces the zeta potential, more particularly with an increase in the clay content from 3 to 10% and in the silicon content from 20 to 40%. A decrease in the water content of the silicon carbide slip with added clay or silicon even from 40 to 35% causes a significant increase in the kinetic stability of the slip; therefore a water content of 35% should not be exceeded. The silicon carbide castings should be fired once only at the ultimate temperature because pre firing at a low temperature reduces their density and strength. With a suitable firing cycle the method of slip casting can be used for forming large clay and nitride bonded products with good ceramic properties. 5pp 11fig 3tab (BCA) Abstr. No. 76/3022

466

Schlegel, D., and R. Rautenbach

Model Tests on Transport Phenomena of Plastic Ceramic Masses with Wall-Sliding-Effect in Extruders

Tonind. Ztg. 99(3), 62

In German. High-concentrated dispersions, such as plastic ceramic masses, show a remarkable wall-sliding effect. This effect renders the rheometric measurements more difficult. Model tests tried to evaluate the flow properties of plastic ceramic masses in extruders without knowledge of rheological data and parameters of wall-sliding. For some special cases it is possible to transform the results of one model to another, if the materials used are identical. In principle a transformation is possible, even by model experiments with different extruders with low pressure gradients, considering the law of similarity. Actually many screw extruders of the ceramic industry are working with low pressure gradients in the screw housing causing plug flow with a wall shearing stress depending on the wall standard pressure. If the pressure is increased the ceramic material is deformed, and the wall effects are

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very difficult to evaluate. Model transformations become impossible. 4pp 7fig 1tab (BCA) Abstr. No. 76/0011

467

Schmidt, H.

New Methods for Influencing and Regulating the Drying of Heavy Clay Bodies

Sprechsaal 108(19/20), 605

In German. (Abstract not available.) 3pp 3fig (BCA) Abstr. No. 76/2254

468

Smolski, A.

The Development of a Continuous Vaporization Drier for the Building Ceramics and Heavy Clay Industry

Silikattechnik 26(4), 113

(Abstract not available.) 4pp 5fig (BCA) Abstr. No. 76/0284

469

Vyas, K.D.

The Drying of Thick Porous Materials

Diss. Abstr. Int. 35(12), 5880-B

Thesis: Illinois Inst. Technol, 1974

An examination of the mechanism of water removal from porous solids, and a mathematical model therefor. Predicted data for a range of ceramic materials agree with experiment. Order No. 75-12 820. 97pp (BCA) Abstr. No. 76/0028

470

Vycudilik, P.

A Contribution to the Mechanism of Peptization of Concentrated Clay Suspensions

Silikaty 19(2), 137

In Czech. Suspensions of three different kaolins containing various electrolytes were investigated by means of a rotary viscometer. The course of coagulation and peptization in the system was assessed on the basis of flow curves $\tau(D)$ --the

dependence of tangential stress on strain rate. Evaluation of the relation of apparent suspension viscosity to the amount of electrolyte showed that the quantity of ions taking part on exchange adsorption on clay particles at optimum peptization was almost always identical when expressed as modified normal concentration. The exchange is generally much less extensive than the exchange capacity of the clay material. 19pp 12fig 1tab (BCA) Abstr. No. 76/1554

471

Xaloy, Inc.

Cylinder for an Extruder or an Injection Moulding Machine

Patent No. Brit. GB 1,383,686, 12 Feb, 1975,

Hollow cylinder for an extruder or an injection moulding machine has on its internal surface a wear- and corrosion-resistant lining comprising tungsten carbide particles dispersed in an alloy, the lining having been formed by centrifugal casting of a mixture of tungsten carbide particles and a fused alloy, the mixture comprising (%) tungsten carbide 30-45, Ni 22-61, Co less than 37, Cr less than 12, B 1.3-3.0, Si 0.7-3.3, Mn less than 1.0, Fe less than 3.3, C less than 0.6. The lining exhibits both the wear and abrasion resistance of high-ferrous content alloy linings, and the anti-corrosive properties of non-ferrous alloy linings. (BCA) Abstr. No. 75/1158

472

Zacharias, G.

Basic Studies on Atterberg Limits

Indian J. Technol. 13(6), 269

The interaction of clay minerals on Atterberg limits is investigated. At high moisture contents the influence of chemicals on clays is different from that at low moisture contents. The variation of Atterberg limits with variation in clay minerals and addition of chemicals is explained. 5pp 6fig 1tab (BCA) Abstr. No. 76/0701

1976 Documents

473

American Society for Testing and Materials

Test for Lead and Cadmium Extracted from Glazed Ceramic Surfaces

ASTM Stand. C738-76

(Abstract not available.) (BCA) Abstr. No. 77/2282

474

Brown, S.M., and D.N. Wallace

Phosphated Alumina Extrudates

Patent No. U.S. US 3969273, 13 Jul, 1976, 3 pp. USA

Extruded Al_2O_3 catalyst supports are prepared containing phosphates, 1-10 weight %, by precipitating the Al salt of $\text{Al}_2(\text{SO}_4)_3$, $\text{Al}(\text{NO}_3)_3$, and AlCl_3 with K or Na aluminate in a pH range of 6.5-10.5 and a temperature range of 90-190 degrees F with an Al_2O_3 concentration of 1-8%. The precipitate is washed to remove the contaminating anions and cations. The washed hydrogel is dried, yielding an Al_2O_3 powder. A solution of H_2O -sol phosphate compound is added to the milled Al_2O_3 powder, which is extruded, dried, and calcined. The phosphate addition improves the activity of the catalyst. (CAS) Abstr. No. CA85(18):131262q

475

Gangadharan, T.K., and A.V. Subrahmanyam

Extrusion Characteristics of Alumina Refractory Bodies

Trans. Indian Ceram. Soc. 35(4), 73

Alumina was milled to 3.26 μm mean diameter, mixed with various proportions of water and of a binder which was starch, wheat flour, prepared wheat flour or gum tragacanth. A small ram extruder was constructed, and the load necessary to start extrusion was measured depending on body composition. Gum tragacanth is a suitable binder, and it is enough if the water content is 20%. 4pp 2fig 5tab (BCA) Abstr. No. 1032/78

476

Jonas, A.J.

Continual Improvement in Dryers

Ziegelindustrie (3), 106

In German. Both tunnel and chamber dryers have advantages. The use of air recirculating systems represented a major development in chamber dryer design, but their construction and particularly their control became increasingly complicated. Simple impulse dryers, which are also in fact chamber dryers, have been employed with success, but they take up a good deal of space, the air circulation is not uniform and is less economical than the dryer with forced air circulation. A combined circulation and impulse system is described. 3pp (BCA) Abstr. No. 76/2608

477

Kobayashi, T., S. Suzuki, and M. Takahashi

Mechanical Behaviour of Plastic Clay Body-Retarded Elastic Deformation

J. Ceram. Soc. Jpn. 84(975), 542

In Japanese. The model is composed of two parts, "I" and "R", arranged in series. Part "I" contributes to the spontaneous elastic deformation and is constituted by many spring elements stood in a row, while part "R" contributes to the retarded elastic deformation and is constituted by many spring elements and dashpot elements all stood in a row. How part "I" behaves has been discussed in a previous paper. Some of the spring elements in part "I" are decayed and changed into dashpot elements, "R". These new dashpot elements, "R" are arranged in a series to each other and join to part "R" in a row. The mechanical behaviour expected from the new model thus derived agreed well with the results of creep tests on a low tension insulator body. 7pp 9fig (BCA) Abstr. No. 77/3190

478

Konta, J.

Rapid Industrial Control of Basic Rheological Properties of Washed Kaolins Using Imbibometry

Interceram 25(4), 249

1976 Documents

The imbibometric method, in which the rate and capacity of imbibition into a sample compressed under constant conditions are measured, can be used to determine the dry strength and flowability of clay materials. The liquid absorbed by capillary action reacts to the size, shape and surface occupied by ions of the components. The imbibometric curves of 54 samples of washed kaolins were expressed by simple measures. The correlation diagrams showed a slight inverse dependence between dry strength and imbibometric measure and a direct dependence between flowability and imbibometric measure. 3pp 5fig (BCA) Abstr. No. 77/2033

479

Kyan, C.P.

Shaped Channeled Catalyst

Patent No. U.S. US 4328130 A, 4 May, 1982, 7 pp. USA

Extrudates with improved catalyst properties are produced by forming $\alpha\text{-Al}_2\text{O}_3\cdot\text{H}_2\text{O}$ shapes by conventional means and then saturating the extrudates with aqueous solutions of catalytic materials before drying the extrudate instead of after drying. The aqueous solution is applied by either dipping the extrudate in the solution for 5-120 seconds or by spraying the solution. The particles are then dried by conventional means. (CAS) Abstr. No. CA97(4):26269x

480

Leisenberg, M.

Method and Apparatus for Automatically Regulating the Plasticity of Clay Masses

Patent No. Brit. GB 1,459,822, 12 Dec, 1976,

This method of automatically adjusting the plasticity of clay masses by addition of water, steam or a dry substance to the mixer of a production chain, including a mixer followed by an extrusion press, comprises the steps of measuring the plasticity of the mass in the head of the extrusion press or in a length of clay extruded therefrom, measuring the power consumption of a drive motor of the mixer, comparing the measured plasticity of the mass with a reference value in a

primary adjustment circuit to obtain a correction value, comparing the measured power consumption with the corrected reference value for the power consumption in an auxiliary adjustment circuit to provide a control signal controlling a dosing device for the metered addition of water, steam or a dry substance to the mixer. (BCA) Abstr. No. 77/0298

481

Maybon, G.

Moulding Machines in the Ceramic Industry

Ind. Ceram. (593), 197

In French. An abrasion resistant layer is soldered to the auger used in pugmills and mixers. 2pp 2fig (BCA) Abstr. No. 76/3213

482

Mostetzky, H.

The Origin of the Plastic Behaviour of Ceramic Pastes

Ceramica 19(2), 1

In Italian. (Abstract not available.) (BCA) Abstr. No. 76/3481

483

Nesby, C.W., and K.G. Huebner

Continuous Process for Preparing Extruded Alumina Bodies

Patent No. Can. CA 997324, 21 Sep, 1976, 7 pp. USA

Alumina pellets are prepared by reacting continuously an alkali metal aluminate, mineral acids and/or Al salts of mineral acids, a compound selected from aldonic acid and aldonates, and an alkali metal silicate in an aqueous solution while maintaining the pH at 5-12. The concentrations of reactants are controlled to maintain the final Al_2O_3 concentration at 1-25%. The resulting precipitate is filtered, dried at 200-1000 degrees F, and the dry powder washed. The dry powder is prewetted with water to form a slurry, which is extruded as pellets. These pellets are used as a fixed bed catalyst. (CAS) Abstr. No. CA87(2):12199f

1976 Documents

484

Pels Leusden, C.O.

Deformation of Plastic Bodies During Drying

Ber. Dtsch. Keram. Ges. 53(10), 291

In German. The mechanism of deformation during drying, due to differences in the shrinkage of different shapes, is explained using three types of test-piece: a sphere, a tube and a plate. Suggestions on how to deal with these different modes of deformation are discussed. 3pp 4fig (BCA) Abstr. No. 77/1232

485

Rieter-Werke Dipl-Ing Walter Handle GmbH

Apparatus for Extruding Flowable Materials

Patent No. Brit. GB 1,421,453, 21 Jan, 1976,

An extruder, e.g., for clay, comprises at least one rotatable cylindrical conveying drum in a housing with an inlet and outlet, circumferentially extending axially spaced projections of equal height on the drum periphery, and a discharge deflector engageable between adjacent projections to divert material conveyed between them to the outlet. The projections are adjacent the housing wall, convey material towards the outlet, and are spaced further from one another in the drum centre than at the ends. The projections are preferably held apart by annular spacers and are annular, both projections and spacers being formed from arcuate segments. The extruder is insensitive to fluctuations in material characteristics and produces an extrudate of uniform structure. (BCA) Abstr. No. 76/0744

486

Roget, M.

The Drying of Ceramics

Ind. Ceram. (691), 17

In French. Theoretical aspects, physical behaviour of substances, influence of particle size on drying, determining dryer parameters and dryers in the ceramic industry are considered. 32pp 37fig (BCA) Abstr. No. 76/2609

487

Salomao, J.R., and P. De Souza Santos

The Effects of Some Additives on the Plasticity Limits of Plastic Ceramic Clays Used for Sanitaryware

Ceramica (Sao Paulo) 22(87), 101

In Portuguese. The purpose was to change the water percentage necessary for extrusion. Three different clays of Sao Paulo State were used. The additives were various detergents, tannic acid, sodium silicate, sodium polyphosphate, sulphuric acid and polyelectrolytes. The nature of the effect depended also on the choice of clay. 16pp 5fig 10tab (BCA) Abstr. No. 77/0864

488

Schuster, P., G. Kruger, and K. Bertsch

Investigations on Texture and Properties of Stoneware. Pt. 4. The Effect of the Moisture Content of a Stoneware Pipe Body During Extrusion on Properties of the Material After Drying and Firing

Ber. Dtsch. Keram. Ges. 53(10), 302

In German. The properties of pipe materials of different recipes and different grog grain sizes were studied as a function of increasing water content during extrusion. In the moisture content region tested the flexural strength of the pipes decreased with increasing moisture content during extrusion. Whilst the strength of rods fired at cone 5a/111 also decreased with increasing moisture content, a maximum was found for the ring flexural strength, which tended to be displaced towards lower moisture contents with increasing grain size of grog. The apparent porosity increased with increasing moisture content, while a linear relationship was found for the total shrinkage. 3pp 7fig (BCA) Abstr. No. 77/1326

489

Siegert, H.

Preparation Equipment for the Manufacture of Electroporcelain

Keram. Z. 28(1), 19

1976 Documents

In German. Modern preparation equipment at a factory in eastern Europe ensures the production of good quality electroporcelain without rejects. The entire preparation is carried out without dust. The raw materials are dried and finally ground to give a consistent product for storage in the ample silos, which then guarantees uniform quality. Articles made range from the smallest insulating components to insulators 4 m long and 1.6 m in diameter. 4pp 5fig (BCA) Abstr. No. 76/1602

490

Taniguchi, T., and T. Sugimoto

Gypsum Composition

Patent No. Ger. Offen. DE 2528304, 22 Jan, 1976, 22 pp.

Japan

In German. High-strength extrudable plaster of Paris (I) [26499-65-0] articles are prepared by incorporating portland cement and 5-50 weight parts of a hydrophilic colloid-forming powder (when I plus the cement totals 100 weight parts). The powder is loess, chloride clay, or Al silicate hydrate (II) [1335-30-4] with average particle size of 20-60 μ . Thus, an article extruded from a mixture I 70, cement 30, with II 10 weight % has an initial setting time of 7 minutes and gives a good product whereas 100 weight parts I containing 10 weight parts II or no additives has setting times of 20 and 23 minutes, respectively, and both products are deformed by cleavage. (CAS) Abstr. No. CA84(16):110669s

491

United Kingdom Atomic Energy Authority

Forming of Silicon Carbide Bodies by Extrusion and Dies Therefor

Patent No. Brit. GB 1,437,178, 26 May, 1976,

Self-bonded SiC rings are made by blending alpha-SiC, C and a binder into a green mix, extruding through a die having a bore with an arcuate longitudinal axis, removing binder from the curved strips, siliconizing and making the strips up into rings. The binder may be removed in profiled grooves in a graphite block to avoid

distortion, and siliconizing is by infiltrating the body by capillary action with molten Si to produce beta-SiC which bonds the alpha-SiC grains. (BCA) Abstr. No. 76/2156

492

Varlamov, V.P., L.A. Kroichuk, and A.A. Toporkova

A New Method for Estimating the Drying Sensitivity of Clays

Ceramurgia Int. 2(2), 98

Fourteen clays with different drying sensitivity were arranged in a series according to results of complex technological tests in a decreasing order of their drying sensitivity. It is proposed to determine only that portion of the losses that is released in the temperature range above the drying temperature, at 100-200 degrees C, in order to compare different clays as regards the interlayer moisture lost during drying. A relationship was found between the amount of moisture liberated at up to 200 degrees C, mineralogical composition and drying behaviour of clays. Having determined the amount of the interlayer moisture lost at 100-200 degrees C, it is possible to quantitatively evaluate the content of component adversely affecting the drying sensitivity and predict the drying behaviour of a given clay. 4pp (BCA) Abstr. No. 77/0624

493

Weber, H.B.

Methods of Reducing the Drying Time by the Appropriate Design of the Kiln Setting

Ziegelindustrie (1), 14

In German. Differences in the drying load are responsible for wide variations in quality, relatively long drying times and increased power consumption. New types of chamber dryer finger car and of tunnel kiln car are indicated, which would make it possible to achieve a decisive improvement in the setting of the drying load and hence of the entire drying process. 2pp (BCA) Abstr. No. 76/2610

1976 Documents

494

Welther, G.E., I. Ionescu, and G. Ion

Apparatus for Reducing the Lengths of Catalyst Extrudates

Patent No. Rom. RO 60728, 24 Dec, 1976, 3 pp.
Romania

An apparatus is described for decreasing the length of catalyst extrudates from 30-80 to 5-8 mm. The apparatus (vertical tube) is divided in segments with metal exterior walls and rubber internal walls. Compressed air is introduced between the walls periodically and alternatively to the segments to reduce diameter and thereby break the catalyst extrudates. (CAS) Abstr. No. CA88(26):193335m

495

Zenz, F.A., and P.N. Rowe

Particle Conveying in Extrusion Flow

Keairns, D.L.(ed.), Fluid. Technol., Proc. Int. Fluid. Conf., Meeting Date 1975, Vol. 2. New York, NY: McGraw Hill, pp. 151-8

USA

Extrusionlike flow of pneumatic powder transport is discussed. In this flow, the density of the gas-powder stream is near the bulk density. A test to identify powders that can be transported this way is presented. A 250 ml cylinder is filled with the powder. A steel ball (diameter 1 cm) is released just above the powder surface. If the ball falls to the bottom, as if through a liquid, the powder is capable of extrusion flow. The property must be permanent and not dependent on aeration immediately before the test. A knobbed brass rod is more convenient to use than the ball. Coal powder (diameter less than 44 μ) passes the test, and its extrusion flow capability was shown in a 1 in. diameter plastic pipe. In glass beads (120 μ), FCC catalyst (43 μ), and TiO_2 (12 μ), the dropped weight penetrated only a short distance. When Cab-o-sil was added to these materials, only the FCC catalyst Cab-o-sil equivol mixture (4 weight % addition) passed the test. (CAS) Abstr. No. CA86(12):75178y

1977 Documents

496

Braaten, T.

Method and Means for Manufacturing Refractory Slabs

Patent No. Brit. GB 1,474,713, 25 May, 1977,

Refractory slabs, for use in foundries as refractory parts in conduits and moulds for molten metals, are produced by simultaneously extruding and dewatering an aqueous slurry of fibres and binding agent. A reciprocating plunger forces the slurry through a transversely elongate passage; dewatering is by the compaction applied by the plunger in combination with vacuum applied from a chamber through a foraminous screen at the passage entrance. The action of the plunger also avoids a preferential fibre orientation in the slab. The mechanical design of the extruder is specified. (BCA) Abstr. No. 77/1985

497

Bulley, O.M.

Piston Extruder

Patent No. Brit. GB 1,461,773, 1 Jan, 1977,

A piston extruder for clay comprises a die member removably mounted to the barrel and a piston reciprocated by a pair of manually operated levers, each of which is pivoted to the barrel and slidable through a pivot connected to the piston. The die member may comprise a plate for extrusion of a tube. The die member is releasably supported by inturned flanges, formed around three walls of the extruder barrel, and a further such flange formed in a door comprising a further wall of the extruder barrel and which is closed by pivotable latches engaging pins at each side, and which is openable about a pivot for removal and replacement of the die, or adaptor, and for cleaning of the barrel and removal of surplus clay. A hopper is provided for loading the extruder with clay. The clay is downwardly extruded through a guide frame having adjustably spaced apart upper and lower members, the outer surfaces of which serve as guides for a wire, or knife, by which a required length of the extrudate may be severed. (BCA) Abstr. No. 77/1218

498

Csaki-Balla, I.

A Rheological Study of Brick Clays for the Characterization of Clay Plasticity

Epitoanyag 29(6), 270

In Hungarian. A method was tried to characterize brick clay plasticity by measuring the rheological (viscous flow) properties of relatively diluted slips. 4pp 2fig 2tab (BCA) Abstr. No. 2016/78

499

Derwinis, J., M. Woznicki, and K. Zebik

Analysing the Efficiency of Decantation and Filtration of Kaolin Suspensions as a Function of Concentration

Szklo Ceram. 28(1), 17

In Polish. It has been tried to analyse this part of the processing of kaolin for the range of concentrations used actually in an existing industrial installation. The output has been determined as the function of the C_0 -initial and the C_L -final concentration. The criterion to establish the optimum values of the parameters was to work in a continuous manner. These values have been found by simulation and by computer calculations. 4pp 8fig (BCA) Abstr. No. 77/2390

500

English Clays Lovering Pochin and Co., Ltd.

Particulate Solids

Patent No. Brit. GB 1,482,258, 10 Aug, 1977,

A mixture comprising a particulate solid material and water is deflocculated with a water-soluble deflocculating agent to form an aqueous slurry which is dewatered to form a cake of reduced water content compared to the slurry, and the cake is subjected to mechanical work comprising at least one cycle of applying and relaxing stress to the cake to form a second aqueous slurry, wherein the solid material is precipitated calcium carbonate or a ground, fritted ceramic glaze composition. The deflocculated mixture is preferably dewatered in a pressure filter, and the mechanical work may be performed by a jaw

1977 Documents

crusher or dough mixer. (BCA) Abstr. No. 77/2674

501

Feistel, G.R., and G.N. Pessimisis

Silica-Alumina Catalysts

Patent No. U.S. US 4039474, 2 Aug, 1977, 5 pp. USA

Al_2O_3 monohydrate carriers were prepared for extruded catalysts, especially for Co-Mo catalysts for desulfurization of petroleum products. The Al_2O_3 monohydrate was mixed with a peptizing agent and H_2O , intensely shear-mixed, extruded, dried, and calcined. In a sample, alpha- Al_2O_3 monohydrate with bulk density 0.45 g/cm^3 was mixed with molybdic acid and Co carbonate, aqueous HNO_3 peptizing agent was added to form an extrudable gel, the product was intensely shear-mixed, extruded, dried, and calcined. The calcined material was treated with ammoniacal Co nitrite-molybdic acid, and again calcined. The product contained Co 3.2 and Mo 12.9 weight % of which metals 75% was introduced by coextrusion and 25% by impregnating. (CAS) Abstr. No. CA87(14):107239h

502

General Refractories Co.

Extrusion Die

Patent No. Brit. GB 1,471,217, 21 Apr, 1977,

A ceramic catalyst support comprises an extruded dried and fired section having parallel circular or square bores, i.e., at least 100, or 195 or more bores/in.². The support may be extruded from stated quantities of kaolin, clay and talc, of which the chemical compositions are given, together with fused cordierite, colloidal magnesium aluminium silicate, and distilled water, using a die plate of stated dimensions and an evacuated extruder barrel. The support is extruded horizontally on to a conveyor from dies comprising a metal or plastics die plate, having passages for the ceramic and which, at its downstream end, is integrally formed with spaced apart pins defining the bores, surrounded by a collar defining the periphery of the section. The

pins each overlap a portion of adjacent pairs of passages and the ratio of the area between the pins to that of the passages, in between 0.65 to 1, to ensure that the ceramic spread laterally from the passages into the space. (BCA) Abstr. No. 77/1727

503

Gorelik, S.S., A.N. Dubrovina, and V.L. Ablamskii, et al.

Recrystallization and Electrical Properties of Low-Temperature Thermoelectric Materials Extruded from Ceramic Blanks

Izv. Akad. Nauk SSSR, Neorg. Mater. 13(11), 1997-2000

USSR

In Russian. Study of the recrystallization and electrical properties of extruded Bi_2Te_3 - Bi_2Se_3 and Sb_2Te_3 - Bi_2Te_3 thermoelectric materials during 1-hour annealing at 320-480 degrees showed that their electrical conductivities and thermoelectric coefficients depend on the particle size of the initial powder and the heat-treatment conditions. (CAS) Abstr. No. CA88(8):57470z

504

Hodgetts, G.B., and A.R.I. Freestone

Extrusion Rheometer for Characterizing Thixotropic Materials

Rev. Sci. Instrum. 48(4), 411

A special form of extrusion rheometer has been developed for characterizing thixotropic pastes and high viscosity materials. It consists of a cylinder with an orifice situated halfway along, and has a piston at each end. In use, a sample plug of material is forced through the orifice at a uniform rate by one of the pistons, and the load required is recorded. After a given recovery period, the material is forced back through the orifice by the other piston, and the load again recorded. If the material is thixotropic, it will have a reduced viscosity on the second "pass", and the percentage reduction in load will be related to the thixotropy of the sample. 3pp 2fig (BCA) Abstr. No. 77/2324

1977 Documents

505

Japanese Standards Association

Testing Method for Workability Index of Fireclay Plastic

Jap. Stand. JIS R 2574

In Japanese. (No abstract available.) (BCA) Abstr. No. 77/3526

506

Lenkei, M.

Rheological Examination of Throwing Bodies Made of Spray-Dried Powders

Epitoanyag 29(2), 41

In Hungarian. The dry material content of a slip suitable for spray drying is approximately 61-62% if sodium carbonate water glass or Dolapix CA are used, slightly lower if sodium humate or sodium tannate electrolytes are used. Electrolyte-containing slips and plastic bodies made of their spray-dried powders have dilatant flow properties, hardening upon shearing. Plasticity is decreased differently by the various activities. Deformation change, e.g., water content ratios, increase in the presence of additives. 4pp 3fig 5tab (BCA) Abstr. No. 1881/78

507

Limburg, G.

Dressing Plant for Brickworks and the Ceramics Industry, Respectively--Regulation of Plasticity. DBP Patent of the German Federal Republic.

ZI Int. (January), 28

In German and English. This dressing plant for brickworks and the ceramics industry consists of a mixer with combined electric motor control and feed devices for raw material and water. Its purpose is to maintain the water content of the dressed materials at a constant level even if the feed substance varies in water content. In this system the current consumed by the mixer motor is analogous to the water content. It is fed to the control circuit as an actual value. 3pp 1fig (BCA) Abstr. No. 632/78

508

Matsushita, K., H. Sakurada, and K. Onuma

Molded Titanium Oxide Product Useful as Catalyst Carrier

Patent No. Jpn. Kokai JP 52/16507 [77/16507], 7 Feb, 1977, 4 pp.

Japan

In Japanese. TiO_2 or its mixture with Al_2O_3 is mixed with at least one compound selected from a water soluble cellulose compound, polyacrylamide, starch, polyethylene glycol, poly(vinyl acetate), higher aliphatic carboxylic acid, polyethylene, urea, and activated C and also an aqueous medium in the presence of inorganic acid or lower aliphatic carboxylic acid, molded, and fired. Thus, 200 g powdered TiO_2 was mixed with a 6 g fine crystalline cellulose and 116 ml 5% HOAc solution, extruded, dried, and fired at 700 degrees for 3 hours to obtain shaped TiO_2 having compressive strength 8.6 kg, surface area 46.11 m^2/g , and water absorption 46%. (CAS) Abstr. No. CA87(16):119960z

509

Mitsche, R.T., H.L. Kuntz, and J.C. Hayes

Method of Manufacturing an Extruded Catalyst Composition

Patent No. U.S. US 4046713, 6 Sep, 1977, 5 pp. USA

Catalysts useful in selective reforming of naphtha to reformat with a high octane number and liquid petroleum gas are prepared by extruding a mixture of acidic Al_2O_3 hydrosol, powdered Al_2O_3 , and powdered crystalline aluminosilicate, drying, and calcining. Thus, a dry blend, particle size 95% greater than 105 μ , of 130 g $\alpha\text{-Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$, 137 g $\alpha\text{-Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$ (weight loss at 900 degrees 23 and 27%, respectively, bulk density 0.8 and 0.36, respectively, and 17 g H-mordenite is mixed with 8.4 ml aqueous H_2PtCl_6 (125 mg Pt/ml, 10 g AlCl_3 hydrosol (12% Al), and H_2O sufficient for extrudability, extruded at 100 psi to 1/32-in. pellets, dried, and calcined at 650 degrees in air to give a catalyst with average bulk density 0.4-0.6. (CAS) Abstr. No. CA87(20):154744d

1977 Documents

510

Miyazaki, H.

Moulding of Extruded Construction Elements Containing Reinforcements

Patent No. Brit. GB 1,474,319, 25 May, 1977,

In the extrusion of material as a prop or beam reinforced longitudinally, and optionally transversely, by wires, bars, strip or mesh, the reinforcement is encased in the material in an extrusion die head outlet passage to which the reinforcement is delivered through a guide tube terminating at a convergent inlet to the passage and to which the material is delivered, from each of a pair of screw or piston extruders, along a passage of a pair forming the branches of a gamma configuration with passages connecting with the outlet via a throttle to retard flow at the passage centre. (BCA) Abstr. No. 77/1873

511

Morikawa, A., Y. Narita, and J. Mizutani

Ceramic Shaped Article from Inorganic Raw Material Powder by Extrusion Molding

Patent No. U.S. US 4180538, 25 Dec, 1979, 5 pp.
Japan

Porous aluminosilicate catalyst supports were prepared by adding excess alkali to the water glass used in their manufacture. The excess alkali (e.g., NaOH) made the products extrudable and increased their pore diameter. In an example, aqueous Na silicate was treated with NaOH, Na silicate water glass was added, H_2SO_4 was added to obtain silica gel, alum was added, Na aluminate solution was added to form a slurry, the slurry was filtered, the filter cake was reslurried with diethylene glycol, and spray dried. The dried product was washed, dried, milled with H_2O , extruded, and calcined at 1100 degrees F. (CAS) Abstr. No. CA92(16):134043z

512

Nippon Tokushu Togyo KK

Method of Making an Extrusion Moulding from Inorganic Material Powder Having Poor Plasticity

Patent No. Brit. GB 1,478,057, 29 Jun, 1977,

An article of inorganic material is sintered from an extrusion comprising particles of the material which have been plasticized by a binder comprising water hardening polyurethane dissolved in a water-soluble solvent, the extrusion being effected into a water bath into which the solvent diffuses and in which the polyurethane is hardened by the water. The solvent comprises dimethylformamide, in a weight ratio of 70% to 30% polyurethane, and preferred weight ratios of the material to the polyurethane and solvent are 100:20 to 100:70 and 100:50 to 100:60. The article may comprise a thin sheet, e.g., 3 mm thickness, or a ceramic honeycomb for use on a catalytic converter for automobile exhaust gas. Examples of materials extruded include cordierite, high alumina and cemented carbides. (BCA) Abstr. No. 77/2073

513

Pels Leusden, C.O.

Shaping by Extruders. Pt. 1. The Rheology of Stiff Plastic Bodies

Keram. Z. 29(12), 665

In German. The viscous properties of ceramic bodies, their yield point and friction on metal surfaces are reviewed with emphasis in what is going on during extrusion. There are various factors which can cause damaging textures. The stress-strain relationships are studied. 4pp 11fig (BCA) Abstr. No. 2751/78

514

Van der Zwan, J., and C.A.M. Siskens

The Green Strength of Unfired Bodies

Klei Keram. 27(5), 82

The green strength and plasticity of unfired clay bodies are hardly influenced by detergents. Cationic detergents, however, cause bodies to have a higher moisture content and increase the plastic behaviour of the material. 6pp 6fig (BCA) Abstr. No. 77/2364

1977 Documents

515

Vecchi, G.

Brick Dies--A Few Technical Notes

Refrattari Laterizi 2(7), 374

In Italian. The notes deal with experiences by several firms in the structure of dies used for extrusion. 6pp 17fig (BCA) Abstr. No. 914/78

516

Warthen, J.L., W.S. Briggs, and M.V. Paggen

Control of Physical Properties of Alumina Extrudates

Patent No. U.S. US 4045372, 30 Aug, 1977, 4 pp.

USA

Extrudates of $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$ having density, surface areas, and pore volumes within a predetermined range are prepared by mixing the Al_2O_3 with a sufficient quantity of water to prepare an extrudable product, aging for 0.5-6 hours, extruding and drying. The Al_2O_3 density and 150-200 angstrom pores increase and 200-300 angstrom pores and pore volumes decrease with aging. The Al_2O_3 is suitable as an exhaust gas converter catalyst support. (CAS) Abstr. No. CA88(2):11383v

1978 Documents

517

Corning Glass Works

Manufacture of Extruded Articles

Patent No. Brit. GB 1,500,134, 22 Feb, 1978,

A honeycomb structure of a particulate ceramic material mixed with an extrusion aid comprises water and methyl cellulose, is extruded through a honeycomb-defining orifice of a die plate to pass through a constricted passage which displaces peripheral portion of the honeycomb inwardly to collapse peripheral cells of the honeycomb and form a peripheral skin of oval shape. The embodiment relates to the extrusion of a catalyst support for an exhaust gas emission control device from a blend of steady proportions of clay, talc, and alumina, of stated particle size distributions and proportions of refractory metallic oxides, which are mainly SiO_2 , Al_2O_3 , and MgO , the proportions of methyl cellulose, water and optionally diglycol stearate, also being stated. The honeycomb may comprise 60-100 cells/in². Application 28687/75, filed 8/7/75. (BCA) Abstr. No. P1162/78

518

Creed, E., and C.W. Jowett

Chemical Vapour Deposition of Wear-Resistant Tungsten Carbide Coatings on Extrusion Dies

Met. Powder Rep. 34(3), 136

Surface Treatments for Protection, Inst. Metall. Ser. 3, (10), 1978, p. 147

The tungsten carbide coatings offer substantial potential improvements when used in extrusion, the authors having studied their performance under laboratory and practical extrusion conditions. Emphasis has been placed on adjusting deposition parameters to optimize the structure surface finish and adhesion of the coatings with reference to their performance in service. 12pp (BCA) Abstr. No. 3982/79

519

Dima, P., E. Lungu, and T. Alexenco

Rheology of Extrudable Pastes for Obtaining Slabs of Fine Ceramic Sandstone

Mater. Constr. (Bucharest) 8(1), 19-22

Romania

In Romanian. The rheology of the paste was determined by using a capillary plasticimeter with a variation in humidity. Creep, stress threshold, mixed creep realm, and the slope curve were determined. (CAS) Abstr. No. CA90(4):28088s

520

Entelis, F.S.

Texturing Plastic Ceramic Bodies

Glass Ceram. (Engl. Transl.) 35(6), 347

To ensure axisymmetrical distribution of shrinkages during firing, a concentric texture is imparted to the extruded column by replacing the die by a texture converter. Thereby the quality of porcelain plates is improved. 3pp 5fig 3tab (BCA) Abstr. No. 3489/79

521

Galeone, G.

A Method of Evaluating Drying Sensitivity

Ceramurgia 8(6), 305

, A shrinkage reader is used both under normal air flow conditions and under accelerated drying conditions. Differences in shrinkage rate observed under the two conditions are related to drying sensitivity. 3pp 1fig (BCA) Abstr. No. 3734/79

522

Ganss, A.H.

Increasing Productivity of Ram Piston Extruders

Mohr, W.C.(ed.), Proc. 1978 Am. Ceram. Soc. Ann. Meeting Mater. and Equipment and White-ware Divs. Columbus, OH: ACS, p. 118.

The following methods of increasing the efficiency of ram extrusion are suggested: use of

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billets, automatic fill of granulate, automatic vacuum control, more efficient vacuum capacity, automatic extrusion control, automation of other phases of press motion, die assembly modifications for guide die changes, mechanical devices for cut-off. 3pp (BCA) Abstr. No. 801/81

523

Gembicki, S.A., and S.H. Aeschbach

Extruded Catalyst

Patent No. Ger. Offen. DE 2656001, 22 Jun, 1978, 24 pp.

Germany, Fed. Rep.

In German. A method is given for preparation of extruded catalysts, especially hydrodesulfurization catalysts. The catalysts were prepared from an oxide, a peptizing agent, and H_2O , mixed by shearing with specified energy input, followed by extrusion of the paste, drying, and calcination. In an example, Al_2O_3 hydrates of 2 types, molybdic acid, and Co carbonate were treated with aqueous HNO_3 , extensively mixed with shearing, extruded, dried, and calcinated. The calcinated product was impregnated with Co nitrate and molybdic acid, slurried with H_2O , dried, and calcined to obtain a Co-Mo catalyst on Al_2O_3 . (CAS) Abstr. No. CA89(12):95702e

524

Handle, F.

Contribution to the Subject of Plasticity in Clay-Water Systems

ZI Int. (9), 472

Following a critical study of the term plasticity as used in ceramic technology, results on the investigation of six building clays with the Brabender Plastograph are presented, from which conclusions are drawn concerning the proper construction and use of pugs. 5pp 3fig (BCA) Abstr. No. 2487/79

525

Heywood, N.I., and J.F. Richardson

Rheological Behaviour of Flocculated and Dispersed Aqueous Kaolin Suspensions in Pipe Flow

J. Rheol. 22(6), 599

The flow behavior of both highly flocculated and dispersed kaolin suspensions was studied using a capillary tube viscometer and two horizontal pipeline test loops. Wall shear rates were varied from 30 to 11,000 s^{-1} . Volumetric solids concentrations ranged from 8.6 to 23.4% for the flocculated suspensions, and from 23.4 to 38.7% for the dispersed suspensions. Over shear rates 30-1000 s^{-1} the rheograms for laminar flow of the flocculated suspensions followed the Ostwald-de Waele power law model, while for shear rates 2000-11,000 s^{-1} , the Bingham plastic model fitted slightly better since the high spring rate range was obtained using the capillary-tube viscometer. Great care should be exercised when scaling up from capillary tube data to pipeline installations, in which the wall shear rate rarely exceeds 500 s^{-1} . The dispersed kaolin suspensions were essentially Newtonian, but at the highest solids concentration a measurable degree of shear thickening was observed. 15pp 7fig 2tab (BCA) Abstr. No. 2524/79

526

Jedlicka, P.

Effect of Deformation History on Behaviour of Clay Bodies During Drying

Sklar Keram. 28(3), 72

In Czech. A body made from clay paste tries to change its shape to one obtained before the last deformation. This consequence of deformation history is called "memory". The mechanism of memory deformation is explained on basis of experimental results. The practical consequences are discussed in relation to a fixed stress in dried ceramic body. 4pp 6fig 1tab (BCA) Abstr. No. 104/79

527

Mattyasovszky Zsolnay, T.

Regulating the Consistency of Clays with a High Pit Moisture Content

Interceram 27(3), 188

The problem is to render the clay stiffer and hence suitable for extrusion. This can be

1978 Documents

achieved by appropriate pit planning, admixing dry clays or fillers, drying the clay, increasing the viscosity by admixing carboxyl methyl cellulose, binding the water by cement of calcined lime as described in this paper. 4pp 6fig 4tab (BCA) Abstr. No. 2722/79

528

Mitsui Mining and Smelting Co., Ltd., and Ltd. Mitsui Kinzoku Sintering Service Co.

Pipe or Pipe Fitting and Method for Manufacturing the Same

Patent No. Brit. GB 1,499,390, 1 Feb, 1978,

A pipe or pipe fitting comprises a sintered hollow cylindrical core member made of ceramic material and an outer sheath mounted in the core member and made up of an easily machinable material having a high mechanical strength. The core is obtained by shaping in a viscous state a ceramic material including a silicon carbide refractory material with a bonding agent such as silicon nitride or silicate, followed by sintering. The outer sheath is a thermoplastic synthetic resin such as polyvinyl chloride, polyethylene and other reinforced plastics materials which have a greater coefficient of thermal expansion than metal. The outer sheath has an inner diameter smaller than the outer diameter of the core diameter. It is placed over the core after first being heated. A particular embodiment has a sheath of cast iron and comprises a pair of sheath halves, which may be bolted together or welded together along the seams between the halves. There is an elastic layer between the sheath and the core. The same arrangements can be applied to a straight pipe. Application 39997/75 filed 30/9/75. (BCA) Abstr. No. P1178/78

529

Pels Leusden, C.O.

Shaping by Auger-Extrusion. Pt. 2. The Production of Faultless Clay-Columns

Keram. Z. 30(2), 93

In German. Poor evacuation increases texture. For adequate evacuation, the vacuum should be high enough and the body should have adequate

surface area. The positioning of the core and the bridge of the pipe extrusion was investigated. Proper design of the extruder reduces dragon's teeth and jerky advance of the column. There are special design problems for extruding columns of dimensions larger than the diameter of the pug-mill barrel. 5pp 22fig (BCA) Abstr. No. 3309/78

530

Pels Leusden, C.O.

Shaping with Augers. Pt. 3. Different Types of De-Airing Auger

Keram. Z. 30(6), 306

In German. The different auger designs are discussed and in particular the function of the individual zones in the de-airing extruder. 4pp 13fig (BCA) Abstr. No. 1383/79

531

Pospisil, H., and S. Brogsitter

Practical Experience with the Use of Highly Wear-Resistant Unwatered Dies

Baustoffindustrie, Ausg. A 21(6), 23

In German. Dies for extruding hollow blocks are described. 3pp 1fig 3tab (BCA) Abstr. No. 3085/79

532

Robinson, G.C.

Extrusion Defects

Onoda, G.Y., and Hench, L.L.(eds.), Ceramic Processing Before Firing, New York, NY: Wiley and Sons, 490 pp, 1978

Extrusion is the process of shaping an object by pushing a material through an opening the size and shape of the cross section of the object. Extrusion equipment may be of two types, the piston extruder and the auger extruder. There are many variations within each type. The products of extrusion may be very small, such as tubes of under 0.06 in. diameter, or very large, such as 36 in. diameter pipes. The process is used to form crude natural clays or refined nonplastics, including oxides, graphite, and metal powders. A variety of green-body defects can arise during the

1978 Documents

forming process. These include lamination, surface and edge tearing, bridge and core cracking, column splitting, segregation, and preferred orientation of particles. The causes and potential cures for these problems are discussed in this chapter. (Author)

533

Russo, V.

Drying Procedures of Heavy Clay Products

Ceramica (Sao Paulo) 24(103), 282

In Portuguese. The physical principles of drying, its rate and accompanying shrinkage are considered. Chamber dryers, tunnel dryers, and rapid continuous drying are described. 9pp (BCA) Abstr. No. 2263/79

534

Somodi, Z.

Effect of Organic Additives on Pressing in the Plastic State

Ceramurgia 8(2), 74-80

Hungary

In English and Italian. Strengtheners, i.e., poly(vinyl alcohol) [9002-89-5], humic acid, lignosulfonic acid [8062-15-5], Mobilcer [39296-20-3], and activated bentonite, were tested in porcelain to decrease the use of oil-containing additives (which caused air pollution). (CAS) Abstr. No. CA90(4):28066h

535

Steele, A.P.

The Balancing of Hollow-Ware Dies

Aust. Natl. Clay 9(2), 5

The effects of auger, die, cores, core bridges and of die-auger distance on the flow pattern of extruded columns are considered. Methods of examining the quality of the column and remedial measures for better balancing by mechanical adjustments are recommended. The effects of die lubrication and of degree of vacuum on the flow pattern are discussed. 3pp (BCA) Abstr. No. 2683/79

536

Steele, A.P.

Some Advantages of Stiff Extrusion

Trans. J. Br. Ceram. Soc. 77(6), viii

Definitions are given of several types of extruded heavy clay product, and the advantages and capabilities of stiff extrusion plants are compared to soft extrusion plants in American conditions. 4pp 9fig (BCA) Abstr. No. 781/79

537

Steele, A.P.

Stiff or Soft?

Aust. Natl. Clay 8(12), 5

The advantages and disadvantages of stiff, as well as soft, extrusion of bricks are listed. Stiff extrusion requires fewer operations. Soft extrusion is better for making small holes and for producing a wide variety of sizes. The clay preparation methods depend both on the type of clay or shale used and on whether stiff or soft extrusion will be practiced. 3pp (BCA) Abstr. No. 1710/79

538

Tsimmermanis, L.Kh.B.

Diagram of the Structural States of the System Clay-Water and its Use for Optimizing the Drying Process of Ceramics

Stroit. Mater. (11), 27

In Russian. A scheme of structural state of the system clay-water during drying is given. All the properties of ceramic products depend on the energy of the bond between water and material. A new concept of the drying process is described as the creation of external conditions for achieving a constant rate of stiffening. An optimum schedule for the drying of drainpipes is given, with an explanation of how to use the proposed scheme to ensure the optimum drying conditions. 4pp 5fig 2tab (BCA) Abstr. No. 3757/79

539

United Kingdom Atomic Energy Authority

1978 Documents

Extrusion

Patent No. Brit. GB 1,489,728, 1 Feb, 1978,

Tubes are continuously extruded by introducing material (which may be ceramic powder) into a passageway of progressively decreasing cross-section and formed between a first member and a second member and moving the first and second members relative to one another to draw material along the passageway by frictional drag and to feed it to and extrude it through an annular extrusion path adjacent to and in communication about its full circumference with the passageway. A stationary framework journals a shaft engageable by a prime mover, the shaft being formed with a location flange which tapers to a shoulder, and a mandrel, thereby providing the floor and/or wall of the passageway. The other wall of the passageway is formed by a die ring similarly journaled in the framework. The passageway is closed by a stationary shoe provided with a single opening to the passageway for feedstock. Rotation of the shaft draws the feedstock into the passageway and causes rotation of the die ring, which may also be driven. The die ring is eccentric to the shaft to provide additional compression of the material as it passes through the extrusion path to form tubes. Alternately two stationary shoemembers permit two sources of extrusion material to be provided, and the extrusion die ring is concentric with the mandrel. More than two shoe members, each with its own feed inlet, may be provided allowing for a high production rate of extended tube. The feedstock to be extruded may be a metal rod or a rod of compactable material in precompact form such as a metal powder or granules of a thermoplastics or ceramic powder. Application 32942/75 and 37674/75 filed 1/8/75 and 12/9/75, respectively. (BCA) Abstr. No. P1129/78

540

UOP, Inc.

Extruded Catalyst

Patent No. Neth. Appl. NL 76/14173, 23 Jun, 1978, 17 pp.

USA

In Dutch. A catalyst for hydrodesulfurization of heavy distillation oils at 315-425 degrees and H-pressure 7-140 atmospheres is prepared by mixing finely divided inorganic oxide with metal compounds, a peptization agent, and enough H_2O to give 50-70% weight loss when heated to 900 degrees. During mixing a shearing stress is maintained for 1-3 minutes equivalent to an energy input of 15-60 W h/lb oxide. The paste is extruded, dried, and calcined. The product is impregnated with more of the metal compounds and is dried and roasted in an oxidizing atmosphere. The finely divided oxide passes a microsieve with 105 μ openings, and can be Al_2O_3 , SiO_2 , ZrO_2 , ThO_2 , B_2O_3 , Cr_2O_3 , MgO , TiO_2 , or mixtures of these. Al_2O_3 is preferred, but especially $\alpha-Al_2O_3 \cdot H_2O$, of which a type with a mean bulk density equals 0.7-0.9 is mixed with a type of density = 0.2-0.3 g/cm³ to give a mixture with density = 0.4-0.5 g/cm³. The peptization agent can be HCO_2H , $AcOH$, $EtCO_2H$, H_2SO_4 , HCl , or preferably HNO_3 . The mixture should remain 10-40% of metal compounds: 1-10 weight % of a Group VIII metal compound and 4-30 weight % of a Group VIB metal compound, added 20-30 weight % before extrusion and the rest during impregnation; e.g., $CoCO_3$ and molybdic acid, or compounds of Ni, Co, Fe, Pt, or Pd. (CAS) Abstr. No. CA89(18):153419f

541

Vycudilik, P.

Microstructure Anisotropy of Green Ceramic Body

Sklar Keram. 28(2), 50

In Czech. The shaping of the plastic body is always connected with a high plastic flow. The anisotropic particles of the clay component are oriented in the direction of the flow and under the influence of the deformation forces in the body, different areas of orientation are arising. The body requires anisotropic properties. The insufficient relaxation and the consequent drying shrinkage contribute to the rise of the internal stresses in the product. The anisotropy of the microstructure and the existence of the internal stresses were studied on plates by the method of humidifying. 7pp 20fig (BCA) Abstr. No. 79/79

1978 Documents

542

Whitman, R.H., and W.A. Barber

Microcrystalline Cellulose as Extrusion Aid-Combustible Filler for AluminaPatent No. U.S. US 5119474, 10 Oct, 1978, 5 pp.
USA

Low density Al_2O_3 substrates are produced by using microcrystalline cellulose [9004-34-6] as an extrusion aid and combustible filler for rehydratable Al_2O_3 . The product is used in the preparation of automobile exhaust catalysts. The lubricant binder is not needed when microcrystalline cellulose is used in place of wood flour. Thus, rehydratable Al_2O_3 was combined with microcrystalline cellulose in a ratio of 70:30 and then mixed with sufficient water to prepare a mixture containing 52% solids. The mixture was mulled for 30 minutes and then extruded. The extrudates obtained were cured at 250 degrees F for 16-18 hours, dried, and then calcined at 1800 degrees F for 30 minutes to obtain a low-density catalyst substrate (26 lb/ft³). (CAS) Abstr. No. CA90(12):91760v

543

Zivanovic, B.M., and O.G. Janjic

Cold Formation of Heavy-Clay Products by the Double-Layer Technique

Ceramurgia 8(4), 201

Yugoslavia

Because of scarcity in Yugoslavia of clays suitable for facing bricks, a double layer laboratory scale extruder was developed by which the internal poor quality clay column was covered by a protective layer of better clay, the volume of which is 8-15% of the total. 6pp 5fig 3tab (BCA) Abstr. No. 2028/79

544

Zivanovic, B.M., and O.G. Janjic

Cold Forming of Heavy Clay Products by the Double-Layer Technique

Ceramurgia 8(4), 201-6

Yugoslavia

In English and Italian. A double layer extrusion method was developed which can produce facing bricks from low-quality raw materials from Yugoslavia. Raw materials from the heavy-clay industry were used: a clay with high carbonate content for the bulk body and a clay from southeastern Serbia for the protective layer. Addition of 15 weight % refractory clay powder in the fabrication produced bricks with no cracks at the contact area with good frost resistance. (CAS) Abstr. No. CA90(8):59809g

1979 Documents

545

Bricks by the Soft Mud Process

Refrattari Laterizi 4(38), 188

In Italian. The manufacturing method at DeBoer BV is described. 5pp 3fig. (BCA) Abstr. No. 1611/80

546

Pugmill Without Dugger

Silik. J. 18(2), 66

In German. For making of Poroton bricks, a continuously operating extruder is described which is not based on an auger. Using 40% less energy and working with 2-2.5 times greater conveying efficiency, it produces a lump having less texture and less stresses than columns produced by conventional pugmills. 2pp (BCA) Abstr. No. 3837/79

547

Balint, P., Z. Juhasz, and T. Skvorecz

Importance of Desorption Isotherms of Clay in Ceramic Drying

Epitoanyag 31(7), 241

In Hungarian. Equilibrium moisture contents of clays are usually represented as desorption isotherms. These data are very important from the point of drying and depend on the mineralogical composition of the clay and on drying parameters. Desorption isotherms allow selection of the drying parameters necessary to obtain a predetermined equilibrium and final moisture content of the body, or alternatively to get the equilibrium moisture content when using a given set of drying parameters. 5pp 3fig 2tab (BCA) Abstr. No. 1904/80

548

Balla, I.

Rheological Study of Brickmaking Clays in Order to Specify Their Characteristic Plasticity

ZI Int. (9), 529

The new plasticity test is based on the concentration dependence of the Bingham yield value.

Results obtained in this way are compared with the Atterberg and Pfefferkorn tests, with green bending strength and with specific surface area for nine Hungarian building clays. 4pp 2fig 2tab (BCA) Abstr. No. 2543/80

549

Chamorro, H.J., and T.G. Krenkel

Generalization of the Quasistatic Method, Determination of Fluidity Value Using Nozzles of Different Dimensions

Bol. Soc. Esp. Ceram. Vidrio 19(1), 25

In Spanish. Equipment for measuring the plasticity of clay by extrusion is described. The pressure required for extrusion was related to the angle of the bore and to dimensions. 4pp 4fig 9tab (BCA) Abstr. No. 4127/80

550

Choca, M.E., and G.R. Feistel

Phosphorus Oxide-Alumina Catalysts using Polycarboxylic Acids as Extrusion Aids

Patent No. U.S. US 4132669, 2 Jan, 1979, 4 pp. USA

A calcined Al_2O_3 -P oxide catalyst support (apparent bulk density 0.67 g/m, crushing strength 16 lb, attrition resistance 99.4%, pill diameter 0.064 in., and 7% pore volume greater than 600 angstroms diameter: Al_2O_3 69, P_2O_5 12, Na_2O 0.05, SO_4 0.34, MoO_3 13.7, and CoO 3.8 weight %) is prepared by slurring 7.5 Al_2O_3 -P oxide powder in 3 gal water, adding 1.8 L of a solution containing MoO_3 1, CoO 0.23, and P_2O_5 0.23 lb, heating the mixture to 180 degrees F for 40 minutes, filtering, drying the filter cake at 150 degrees F for 4 hours, mulling the material with 3 weight % citric acid [77-92-9] (as an extrusion aid) extruding through a 0.25 in. die and then through a 5.14-in. die, breaking the pills, drying at 200 degrees F for 2 hours, and calcining at 1100 degrees F for 2 hours. The crushing strength of the extrudate is greater than that of materials not treated with citric acid. Such extrudates are catalyst supports in petroleum refining. (CAS) Abstr. No. CA90(22):171294m

1979 Documents

551

Fan, L.T., et al.

Studies of Multicomponent Solids Mixing and Mixtures. Pt. 3. Mixing Indices

Powder Technol. 24(1), 73

Four approaches to assess the homogeneity of a multi-component solids mixture have been proposed in this study. The mixing indices proposed are estimated on the basis of (a) the pseudo-binary mixture concept, (b) the pooled variance of the whole system, (c) determinant of the sample covariance matrix, or (d) absolute deviations from the population means. The use of various mixing indices for multi-component mixtures has been shown through a ternary mixture. 17pp 4fig 5tab (BCA) Abstr. No. 2843/80

552

Fratzsch, K.R.

The Rhythmic Principle of Drying in Technical Ceramics

Silikattechnik 30(1), 16

In German. Based on drying technologies usual for large bodies of high-voltage ceramics two variants of a method using a rhythmic air movement are presented and include the principles of controlled humidity drying. The advantages of the new method are briefly described. 4pp 1fig (BCA) Abstr. No. 3853/79

553

Garcia Verduch, A.

Drying Behaviour of Clay Bodies

Ceramurgia 9(2), 65

The distinctive features of the drying process when applied to ceramic bodies are briefly outlined. The different states of the water in the clay bodies and the practical criteria to deal with them in drying ceramic products are described. The successive drying stages and the main factors which govern the water movement inside the wetted clay are discussed. DTA curves of quartz, bentonite and kaolin are presented. 12pp 10fig (BCA) Abstr. No. 1503/80

554

Gembicki, S.A., and S.H. Aeschbach

Extruded Catalyst Composition

Patent No. U.S. US 4036784, 10 Jul, 1977, 6 pp. USA

A honeycomb-shaped ceramic was prepared by kneading the ceramic raw materials with a plasticizer and extrusion molding. The ceramic had no deformation or strain. Thus, 100 volume parts ceramic raw material [Al_2O_3 94, SiO_2 3, and CaO 1.5 weight %] was kneaded with 145 volume parts monoliquid type polyurethane resin, extrusion molded to obtain an elongated strip, cut, heated at 200 deg/hr and maintained at 1620 degrees for 2 hours. The sintered strip has no strain or curvature and is useful as an electronic circuit insulating substate. (CAS) Abstr. No. CA87(16):123356z

555

Handle, N.

Novel Solutions for the Preparation and Storage of Ceramic Bodies and Recent Experiences with Extrusion Using Modern Extruders

Silik. J. 18(1), 12

In German. The advantages and techniques of vacuum in the extruders are discussed. The strength of bricks increases with the degree of homogeneity achieved in the pugmill, where much energy must be used to this effect. The pugmill performs the double function of homogenization and conveying to the maximal extent by devices described here. The efficiency of conveying by the auger is low, because part of the clay flows back, which, in turn, improves homogeneity. A conveying efficiency of 0.4-0.5 is recommended. Design directives for the shape of the extruder and especially of the die are given. The unavoidable texture inhomogeneities are explained. With the help of a computer program, the die should be designed to minimize flow velocity variations. The importance of carefully regulating the water content is stressed. Several pictures are presented of a modern vacuum extruder, which incorporates the recommenda-

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tions made in this text. 9pp (BCA) Abstr. No. 3515/79

556

Hennicke, H.W., and E. Kienow

Organic Plasticizers for Fine Ceramic Bodies. Pt. 2. Effects of Organic Additives

Ber. Dtsch. Keram. Ges. 56(5), 95

In German. The effects of surface active agents, water-soluble polymers and of polymer dispersions on the plasticity, green strength, green density and drying shrinkage of porcelain and alumina bodies was investigated. 8 pp 2fig 4tab (BCA) Abstr. No. 937/80

557

Hennicke, H.W., and E. Kienow

Organic Plasticizers for Fine Ceramic Masses. Pt. 1. Models of Plasticity and Measurements of Plastic Behaviour by a Cyclic Shear Test

Ber. Dtsch. Keram. Ges. 56(3/4), 67

In German. This paper describes rheological models of plastic bodies and a technique of measuring plastic behaviour by a cyclic shear test on a parallelepiped block. The shear stress as a function of the shear is recorded. Mechanical hysteresis loops are obtained, which are characteristic for the plasticity of the specimens. In a method for evaluation of the hysteresis loops, parameters both dependent and independent of the water content are considered. A possible interrelation between the obtained parameters and the actual plastic deformation behaviour of the bodies is discussed. 5pp 7fig (BCA) Abstr. No. 2761/79

558

Hermansson, L., and R. Carlsson

An Empirical Method of Measuring the Drying Sensitivity of Ceramic Bodies

Trans. J. Br. Ceram. Soc. 78(5), 98

An assessment of the results of the drying behaviour of six industrial ceramic bodies shows the validity of the method. The tendency for

crack formation is related to the time relation between surface and total linear shrinkage. 5pp 8fig 2tab (BCA) Abstr. No. 2578/80

559

Hrma, P., and L. Brozova

Influence of Non-Plastic Component Content on the Solidification of Ceramic Bodies

Sklar Keram. 29(3), 65

In Czech. By the experimental method described here, a rate equation for the drying process is established. The dependence of drying on the percentage of non-plastic component was investigated and put into a mathematical form. 2pp 2fig (BCA) Abstr. No. 235/80

560

Isenhour, C.T.

Influence of Die Design on the Quality of Extrudate

Am. Ceram. Soc. Bull. 58(8), 766

The effect of auger speed and entrance taper of dies on three different mixtures used in the manufacture of structural clay products is reported. The different clay mixtures were extruded under varying speeds and different tapers to determine the plastic strength characteristics under stress-strain conditions. 3pp 5fig 1tab (BCA) Abstr. No. 375/80

561

Kerstan, W.

The Freezing Test of Clay Columns

Sprechsaal 112(2), 151

In German. Fine fissures appearing in extruded clay columns after firing are thought to be present in the green state. They are made visible by freezing the column and then thawing it. The textures observed on several clays are illustrated and explained. 2pp 8fig 3tab (BCA) Abstr. No. 220/80

562

Korner, R.

1979 Documents

Experiences and Conclusions from the Body Preparation Section at Ilmenau

Silikattechnik 31(8), 248

In German. Porcelain preparation via spray drying at VEB Henneberg Morzellan Ilmenau is described. On the basis of 5 years experience with this technique, it is compared with the traditional route. 3pp 1fig (BCA) Abstr. No. 2005/80

563

Lingl, H.

Innovations in Drying and Firing Technique in the Manufacture of Heavy-Clay Products

Keram. Z. 21(4), 210

In German. Large tunnel dryers are equipped with propelled fans which stand vertically among the charge and have diameters up to the height of the tunnel. More uniform preheating is achieved in tunnel kilns by high-velocity burners of comparatively low temperature and by other means. The Lingl coal-firing system is briefly described. Novel constructions of walls, roofs and kiln cars save energy and ensure more uniform temperature. Methods of linking dryers to off-gases of kilns via recuperators are mentioned. 2pp (BCA) Abstr. No. 826/80

564

Miskarli, A.K., et al.

Effect of Surface-Active Agents on the Structural Mechanical Properties of Ceramic Bodies

Glass Ceram. (Engl. Transl.) 36(10), 563

The plasticizing action of anionic cationic and non-ionic surface agents on earthenware bodies was evaluated. By adding one particular non-ionic surface active agent, the mechanical strength of the body was increased by 20%, and it acquired improved moulding properties. 4pp 3fig (BCA) Abstr. No. 3980/80

565

Moravek, J.

The Process of Drying. Pt. 2. The Rheological Model of the Material

Interceram 28(2), 132

Methods of measuring all material parameters required to define the rheological type of the body during drying are described. Two rheological types are considered. The treatment includes moisture conductivity and its measurement. 4pp 8fig (BCA) Abstr. No. 1845/80

566

Moravek, J.

The Process of Drying. Pt. 1. Determination of the Critical Functions

Interceram 28(1), 22

Methods measuring all material parameters relevant to transfer coefficients, the necessary measuring equipment, tabulated data in the form of computer-usable equations and more accurate expressions for heat and moisture transfer coefficients are described. 5pp 6fig 1tab (BCA) Abstr. No. 3861/79

567

Mostetzky, H.

Drying of Ceramic Bodies. Pt. 1. An Introduction to the Physical Fundamentals

Ber. Dtsch. Keram. Ges. 56(5), 119

In German. The three stages of the drying curve are explained. 4pp 7fig. (BCA) Abstr. No. 1068/80

568

Ries, H.B.

Body Preparation in Fine Ceramics

Keram. Z. 31(7), 386

In German. Following a review of established preparation methods based on filter pressing and spray drying, the production line for the dry preparation technique is described, based on dry ground raw minerals, mixed with slip in an Eirich mixer, extruded and plastic shaped. Details are given on how to make earthenware, porcelain and stoneware, including automatic control arrangements. Lower labour costs, less raw materials

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requirement, better moisture control and faster production are balanced by the need for more expensive raw materials. The slip addition and extrusion steps are replaced by granulation of the dry ground mix, if shaping is to be done by isostatic pressing. 4pp 10fig (BCA) Abstr. No. 2002/80

569

Salamone, A.L., and J.S. Reed

Extrusion Behaviour and Microstructure Development in Alumina

Am. Ceram. Soc. Bull. 58(12), 1175

A Bayer process alumina prepared in various stages of flocculation and agglomeration was extruded and sintered. Apparent flow stresses during extrusion were measured, and fracture surfaces of green and sintered material were examined by SEM. Ideal material for extrusion was in a flocculated state and contained sufficient liquid to fill approximately 95% of the pore space as prepared. Direct mixing of the AlCl_3 flocculant did not produce extrudate comparable to that produced by ball milling and filter pressing. Sintered density ranged up to 3.95 g/cm^3 , and ultimate crystal size was affected by agglomerates and perhaps alkali in the alumina powder. 4pp 5fig 2tab (BCA) Abstr. No. 1692/80

570

Salamone, A.L., and J.S. Reed

Preparation and Microscopic Analysis of Cellulose Binder Solutions

Am. Ceram. Soc. Bull. 58(6), 618-19

USA

Solutions of 2.0 weight % Me cellulose [9004-67-5] and hydroxyethylcellulose [9004-62-0] were prepared by adding the powder to distilled H_2O (22 degrees) and agitating. These binders-plasticizers were used in extrusion of technical ceramics. Undissolved particles in the solutions are caused by slow solution rather than saturation and were eliminated by filtering the distilled water to eliminate dust contamination, adjusting the H_2O with 0.2M NH_4OH to 8.0, heating the cellulose derivative to 75-80 degrees while mix-

ing, cooling, and pressure filtering. (CAS) Abstr. No. CA91(14):111515v

571

Schmidt, H.

How to Prevent Drying Cracks

ZI Int. (7), 399

The drying sensitivity of various types of building clays is tabulated. The sensitivity reducing effects of sand, fly ash, lime and organic fibers are plotted. The effect of a wide range of additives on drying sensitivity, drying shrinkage, green strength and plasticity is tabulated. The Bigot curves of many building clays are presented. Some of the cracking during drying originates from clay preparation, and shaping conditions and preventative measures are proposed. For avoiding cracks due to drying itself, a list of suggestions is presented. Readsorption of water after drying should be avoided. 10pp 7fig (BCA) Abstr. No. 1955/80

572

Schmidt, H.

Physical and Chemical Methods of Investigation in the Heavy-Clay Industry

Sprechsaal 112(1), 16 (Pt. 1); 112(2), 101 (Pt. 2); 112(3), 162 (Pt. 3); 112(7), 477 (Pt. 4); 112(9), 607 (Pt. 5); 113(1), 56 (Pt. 6); 113(2), 125 (Pt. 7); 114(1), 19 (Pt. 8); 114(11), 808 (Pt. 9); 115(1), 48 (Pt. 10); 116(1), 12 (Pt. 11); 116(10), 878 (Pt. 12); 117(6), 571 (Pt. 13); 117(8), 692 (Pt. 14); 117(10), 934 (Pt. 15); 118(11), 1090 (Pt. 19); 119(1), 14 (Pt. 20); 114(3), 158 (Pt. 21)

1979-1986

Title varies. In German. C. Schmidt-Reinholz is principal author of articles since 1981 (from Pt. 8). A continuing series. Topics include: Sampling; harmful coarse constituents and lime blowing; basic physical investigations; particle size distribution; Bigot-curve measurement, green bending strength; drying sensitivity; water sorption capacity; mineral content; water-soluble salts; chemical analysis; fluorine determination; lime and carbon determination; sulphates and sulphides; plasticity; sintering curve determina-

1979 Documents

tion; softening behavior during firing; and maximum permissible maturing temperature.

573

Shershnev, A.A.

Unified Desorption Isotherms for Porcelain Bodies

Glass Ceram. (Engl. Transl.) 36(9), 500

An equation valid for all porcelain bodies is presented for the moisture content per saturated moisture content depending on relative humidity of air. 4pp 2fig 3tab (BCA) Abstr. No. 3979/80

574

Steele, A.P.

Soft and Stiff Extrusion--A Comparison

ZI Int. (2), 93

In the USA, Canada, and other overseas countries stiff extrusion processes are predominantly used with a moisture content of 10 to 20%. This process has the advantage that the green bricks can be transferred direct by machine or by hand to the kiln car after extrusion without any risk of deformation. Because of the slight moisture content, shrinkage remains at a low level. Energy consumption on firing is also low. For the production of large-size blocks with a high perforation volume and thin webs, the soft-mud process is of advantage. The advantages and disadvantages of the two processes are compared. 4pp (BCA) Abstr. No. 3883/79

575

Sychev, M.M., and L.B. Svatovskaya

Preparation of Strong Materials from Dispersions in the Presence of Reactive Phases

Inorg. Mater. (Engl. Transl.) 15(1), 103

The theoretical principles for the production of materials by condensation of highly-concentrated dispersions, including reactive low-temperature melts, are given. 5pp 1fig 2tab (BCA) Abstr. No. 4102/79

576

Tellier, C., M. Risse, and M. Vouillemet

Water Migration in a Fine Ceramic Body During Drying

Bull. Soc. Fr. Ceram. (122), 35

The three phases of diminishing drying rate with time are explained. Previous work on moisture gradient during drying is reviewed. In the present work moisture gradient in vitreous china sanitary-ware bodies in process of drying was studied. 9pp 17fig (BCA) Abstr. No. 71/80

577

Thoma, K.

Economical Drying with High Temperatures, Presented with Reference to the H,X-Diagram

ZI Int. 32(5), 294

An h,x-diagram is presented for use in the drying of ceramic products. It provides for the entire range of air conditions during the drying process to be covered. The application and significance of the diagram are explained with reference to a number of examples of actual dryers used in industry. The relationship of the heat consumption during drying to the hot air temperature and to the residual moisture of the green bricks are particularly emphasized. The different types of Novokeram air circulation units are presented. 13pp 18fig 2tab (BCA) Abstr. No. 4505/80

578

Triki, A.

Alumina Preparation and Use as Carrier Containing Catalysts

Patent No. U.S. US 4172809, 30 Oct, 1979, 8 pp.

Al_2O_3 of controlled porosity is formed with extrusion of the Al_2O_3 in the presence of an organic solvent such as an alcohol. This Al_2O_3 is suitable for use as catalyst or catalyst carrier. Example catalysts were prepared with precipitation of Al_2O_3 , extrusion with varied amounts of EtOH without or containing Et4Si, calcination, impregnation with Co and Mo, and tests in hydrodesulfurization of a vacuum gas oil. The

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example catalysts were generally more active than catalysts prepared with extrusion in the absence of alcohol. (CAS) Abstr. No. CA92(2):11831x

579

Usatikov, I.F., and N.M. Kozhina

Influence of Peptizing Agents on the Electrokinetic Potential of Clay Suspensions

Glass Ceram. (Engl. Transl.) 36(3), 156

The effects of water glass, soda ash, sodium tripolyphosphate and sulphite yeast waste on the pH, viscosity and zeta potential of clays used for making refractories by slip casting was investigated. 3pp 4fig 1tab (BCA) Abstr. No. 1389/80

580

Van der Velden, J.H.

Analysis of the Pfefferkorn Test

ZI Int. (9), 532

A study was made of the suitability of impact tests--in particular the Pfefferkorn test with falling disk--as a means of establishing the shear resistance of clay bodies. Impact tests were performed on three different Dutch clays, demonstrating that the shear resistance of a clay body is mainly determined by the specific surface of the clay, by the difference between the water content of the clay tested and the water content of this clay at its rolling out limit, and, finally, by the impact energy exerted per unit volume on the specimens subjected to impact. 11pp 10fig 3tab (BCA) Abstr. No. 2544/80

581

Van der Velden, J.H.

Analysis of the Pfefferkorn Test

Klei Keram. 29(3), 42

Netherlands

In Dutch. It is investigated how far butting tests and, in particular, the Pfefferkorn test can be utilized for the determination of the stress strength of clay bodies. Butting tests on three different Dutch clays demonstrate that the shear strength of a clay body is determined substantially by the specific surface of the clay, the difference between the water content of the body and water content at the lower plastic limit of the clay, as well as by the butting energy per unit of volume of the butted specimen. 15pp 10fig 4tab (BCA) Abstr. No. 4083/79

582

Wendt, F.

Trials for Shaping by Stiff Extrusion, Using Clay Raw Materials of the GDR

Baustoffindustrie, Aug. A 22(3), 23

In German. Trials were made with the most promising clays, such as have neither too high or too low plasticity. Stiff and soft extrusions were compared as regards properties of green and fired products and process economics. Conversion of an existing soft extrusion based plant to stiff extrusion is not recommended. 3pp 6tab (BCA) Abstr. No. 1609/80

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583

Balkevich, V.L., Yu.M. Mosin, and M.N. Firsova

Determining Plastic Strength to Evaluate the Forming Properties of Ceramic Compositions

Glass Ceram. (Engl. Transl.) 37(4), 182

The effects of carboxymethyl cellulose sulphite liquids and sodium silicate additives on the plasticity of porcelain bodies was investigated by a modification of the Atterberg test. 3pp 2fig 1tab (BCA) Abstr. No. 2223/81

584

Baumann, W.A.

Extruded Catalyst Manufacture

Patent No. U.S. US 4219521, 26 Aug, 1980, 5 pp.

A method is described of manufacturing an extruded catalyst base or an extruded catalyst. The extrudate strands are dropped into the first end of a revolving drum having blades attached to its inner surface. The extrudate strands resting on the blades are lifted and then dropped upon a revolving impacting means which is rotated in the opposite direction to the drum. This produces extrudate particles of a suitable length for the subsequent catalyst manufacturing steps. (CAS) Abstr. No. CA94(2):8196e

585

Denton, R.P.

Pugmills and Extruders for the Ceramics Industry

Br. Ceram. Rev. (43), 16

The distinction between pugmills and extruders is explained. Their history is briefly reviewed, with particular emphasis on the improvements brought about by de-airing. Applications to pottery, heavy-clay products and to porcelain insulators are briefly described. 2pp 4fig (BCA) Abstr. No. 1800/81

586

Escardino Benlloch, A., M.C. Gastaldo Paris, and J.L. Amoros Albaro

Ceramic Clays from Valencia (Spain). IV. Study of a Few Clays from Maetrazgo

Bol. Soc. Esp. Ceram. Vidrio 19(5), 341-5

Spain

In Spanish. Determinations of porosity and contraction properties as functions of fusion temperatures, chemical compositions, DTA and thermogravimetric analytic data, and x-ray diffraction patterns were used to characterize the clays from deposits near Morella, Chiva de Morella, Vallbona, Traiguera, and Cuevas de Vinroma. The test results indicate the presence of gypsum-free, kaolinite-illite clays which in all sampled deposits except those of Chiva de Morella represent commercial-grade raw materials suitable for use in the manufacture of glazed tiles and/or extruded ceramic wares. (CAS) Abstr. No. CA94(20):160086b

587

Fawcett, J.D.

Horizontal Stiff Mud Pressing of Stoneware Pipes

Keram. Z. 32(4), 189

In German. The horizontal extrusion process and equipment for this purpose made by Craven Fawcett are described. 2pp (BCA) Abstr. No. 3928/80

588

Filippi, C.

Lamination in Clay Extrusion, Causes and Correction

Brick Clay Rec. 177(2), 28

Typical mineral compositions of building clays are given. The plastic component is either kaolinite or illite. Illitic clays are less pure. Laminations originate in the extrusion process. They are bonded during firing by the glass phase, unless forced apart by the CO₂ originating from carbonates. 3pp 3tab (BCA) Abstr. No. 828/81

589

Filippi, C.

1980 Documents

Lamination in Clay Extrusion, Causes and Correction

Brick Clay Rec. 177(5), 44

The effect of organic binders on extrusion is briefly discussed. Various types of auger machines are described. Parallel clay columns in contact should move at different speeds. Otherwise they will not knit together, and lamination results. The function of liners is explained. In the absence of de-airing, air bubbles cause lamination when the pressure is released in one column emerging from the die. (BCA) Abstr. No. 1482/81

590

Filippi, C.

Lamination in Clay Extrusion, Causes and Correction

Brick Clay Rec. 177(4), 32

Lamination problems can often be averted by careful attention during mining and storage. Blending is a key element for success. The type of clay or shale determines the preparation process. 3pp (BCA) Abstr. No. 1163/81

591

Gratz, R.

Formation and Classification of Textures in Extruding

Keram. Z. 32(2), 76

In German. The optical classification of texture formation can lead to false conclusions. In classifying texture formation, it is most important to determine the influence on strength and strength differences in the body. Two quantities make allowances for this: the index of texture and the strength related to texture. Both are easy to determine and describe the formation of textures quantitatively. The different kinds of textures and their place of formation in the moulding machine are described. Some hints are given on how to avoid or reduce texture formation. 4pp 4fig 1tab (BCA) Abstr. No. 3918/80

592

Handle, R.

Vacuum Combined De-Airing Extrusion Units in the Heavy-Clay Industry

ZI Int. 32(5), 267

The process occurring in the auger and in the extruder head are described, and model tests, which have served to promote the development of screw extruders, are referred to. Conditions necessary for good extrusion are discussed in detail, and factors determining the quality of mixing are mentioned. The Optimat and Variat extruders, designed on the basis of model experiments and theoretical consideration, are presented. 8pp 9fig (BCA) Abstr. No. 4242/80

593

Hanykyr, V., and J. Havrda

A Method for the Optimization of Porcelain Drying and Firing Process

Vincenzini, P.(ed.), Energy and Ceramics. Proc. 4th Int. Meeting on Modern Ceramics Technologies at Saint-Vincent, Italy, May 28-31, 1979. Amsterdam: Elsevier, p. 252.

Required values for simple shapes were obtained using specially designed laboratory equipment. During the constant rate of drying period the drying conditions are characterized by the rate of drying, the limit difference in moisture content between the body centre and its surface and by the body moisture diffusion coefficient. Combined electric resistance and convection drying is a new alternative. The limit firing curve is a function of limit temperature difference in the body being fired, of thermal conductivity, of shape and of characteristic body dimension. The range within which the clay component of the material is dehydroxylated is the critical stage of porcelain firing until the liquid phase appears. 14pp 7fig 2tab (BCA) Abstr. No. 2979/81

594

Hennicke, H.W., V. Breme, and A.-R. Sarlak

The Effect of the Composition of Structural Stoneware Bodies on Their Plastic Deformation

Ber. Dtsch. Keram. Ges. 57(6/8), 135

1980 Documents

The effect of grogging on the shear stresses during extrusion was studied using six different clays with additions of cleaning agents. Resistance to deformation was determined by measuring the torque of a laboratory extruder. An attempt was made to relate the deformation values obtained, the quality of the column, the fine grain content (corresponding to the content of clay minerals), the coarse grain content and the amount of mixing water, all these being in turn related to the Pfefferkorn value. 5pp 8fig 1tab(BCA) Abstr. No. 440/81

595

Hulsenberg, D., and H.G. Kruger

The Rheological Properties of Bodies used for Plastic Shaping in the Presence of Liquefying Agents

Silikattechnik 31(3), 84

In German. Narrow permissible limits of water content are discussed on the basis of strength measurements of plastic bodies originating from spray drying. 3pp 6fig (BCA) Abstr. No. 3988/80

596

Krahl, K., C. Richter, and K. Schubert

Contribution to the Moulding Behaviour of Spray-Dried Fine Ceramic Plastic Bodies

Silikattechnik 31(3), 81

In German. The influence of spray-drying upon different liquidefying media are characterized, and the moulding behaviour of an electrolyte-containing fine ceramic plastic body was investigated. The method given by Linseis proved to be suitable in characterizing the influence of electrolyte upon the plasticity of investigated model bodies. The moulding properties of a plastic body depend on the type of the chosen electrolyte. 4pp 4fig 3tab (BCA) Abstr. No. 3987/80

597

Lyubarskii, A.I.

Determination of Maximum Safe Drying Rate of Structural-Clay Products

Stroit. Mater. (11), 10

Soviet Union

In Russian. Results are presented on the moisture diffusion at the shrinkage stage during the drying of plastic shaped bricks in countercurrent tunnel dryers. An analytical correlation was obtained between the constructional and technological parameters of the dryers and the maximum permissible drying rate of the clay bodies. The maximum moisture gradient from the surface to the centre of the samples in countercurrent tunnel dryers occurs during the final stage of shrinkage. A method is suggested for calculating the maximum safe drying rate. 2pp (BCA) Abstr. No. 1821/81

598

Moravek, J.

The Process of Drying. Pt. 3. Tension Problems Arising During the Drying of Glass Melting Pots

Interceram 29(1), 25

The stresses arising during the drying of glass melting pots, due to different drying rate of the bottom and of the walls are discussed. Drying arrangements in chamber dryers and in tunnel dryers are compared from this point of view as well as from that of energy consumption. 4pp 4fig (BCA) Abstr. No. 4086/80

599

Nippon Light Metal Research Laboratory, Ltd., and Ltd. Nikkei Kako Co.

Extruded Active Alumina Products with High Strength

Patent No. Jpn. Kokai Tokkyo Koho JP 55/85458 [80/85458], 27 Jun, 1980, 4 pp.

Japan

In Japanese. Transition Al_2O_3 prepared by contacting $\text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$ with hot gas at 500-1000 degrees is mixed with Alpha- Al_2O_3 , quartz, TiO_2 , ZrO_2 , Cr oxide, SiC, Si_3N_4 , and/or BN at a 100:(40-400) weight ratio, mixed with water at a 100:(15-60) weight ratio, extruded, hydrated, and fired. The extruded products have high strength

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and are useful as catalyst supports, etc. Thus, a mixture containing transition Al_2O_3 (diameter 8.3 μ) 50, α - Al_2O_3 50, water 38, and CM-cellulose 2 parts was extruded, hydrated in hot water at 95 degrees for 20 hours and fired at 850 degrees to obtain an Al_2O_3 product having specific surface 47 m^2/g and crushing strength 1150 kg/in^2 . (CAS) Abstr. No. CA94(2):7019n

600

Sakai Chemical Industry Co., Ltd., Sakai

Support for Catalyst Production

Patent No. Jpn. Kokai Tokkyo Koho JP 55/142541 [80/142541], 7 Nov, 1980, 3 pp.

Japan

In Japanese. Support material containing TiO_2 as main component or its precursor is mixed with synthetic mica $\text{KM}_{2.5}\text{Si}_4\text{O}_{10}\text{F}_2$ (and optionally with catalyst material or its precursor) and extruded by an Orgar machine. The extrusion speed is high. Thus, metatitanic acid dried at 100 degrees C, that calcined at 600 degrees and of specific area 70 m^2/g 30, and Dimonite (Topy Industries, Ltd.) 1.5 kg were blended, mixed with 30 l 2% aqueous Poval, kneaded twice by a vacuum bag mill, and extruded through a die at 50 kg/cm^2 and 750 m/min, vs. 25 and 320 with kibushi clay. When dried at 100 degrees for 12 hours, calcined at 450 degrees for 3 hours, and exposed to heavy oil combustion gas at 250 degrees containing 800 ppm SO_2 for 1 mo, the strength along the extrusion was constant at approximately 30 kg/cm^2 vs. decreased to approximately 22 with the kibushi clay sample. (CAS) Abstr. No. CA94(12):91148j

601

Schmidt, H.

Measures to Counteract Defects in Bricks During Firing

ZI Int. (3), 153

The mineral composition of twenty building clays is presented and its effect in the individual zones of the firing cycle is explained. For preventing firing faults (cracking, chipping off, discoloration), which can arise in pre-heating,

firing and cooling zones, several practical possibilities are suggested. The following aspects are treated in particular: sensitivity during heat up, black core formation, quartz inversion, decomposition of pyrite resulting in sulphate formation, lime blowing, bloating, underfiring as indicated by nature of new minerals formed, colour development components susceptible to efflorescence and cooling sensitivity. 10pp 8fig 1tab (BCA) Abstr. No. 3931/80

602

Sentker, U.

De-Airing of Ceramic Clays in Extrusion

ZI Int. 32(5), 278

Two aspects of de-airing are discussed. The progress of clays in the extruder are determined by the mechanical arrangements and the types of bumps to produce the vacuum. The advantages of integral all-steel extrusion screw with degressive helix are pointed out. 7pp 15fig (BCA) Abstr. No. 4243/80

603

Srivastava, L.K., and S.S. Wadhwa

Advances in the Manufacture of Extruded Clay Bricks in American Continent

Indian Ceram. 23(3), 161

All stages of brick-making in modern American plants are described. 8pp 7fig (BCA) Abstr. No. 1818/81

604

Srivastava, L.K., and S.S. Wadhwa

Laminations in Ceramic Products Caused by Extrusion Machines--A Review

Euroclay 5, 18

The processes occurring in the auger section pressure head and die are discussed in detail, depending on design of these sections, on operating condition and on the type of clay. Recommendations are made on how to adjust these parameters to avoid laminations. The advantages of de-airing are explained. 5pp 7fig (BCA) Abstr. No. 1156/81

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605

Taylor, D.A., and S.J. Wright

Design and Application of Abrasion-Resistant Al_2O_3 Lining

AUSTCERAM 80, Proc. 9th Aust. Ceram. Conf. held in Sydney, Aug. 27-29, 1980. Kensington, NSW, Aust. Ceram. Soc., 1980. p. 279.

Alumina ceramics are bonded to steel. Application to brick extrusion dies is described in detail. Applications in other abrasive conditions are mentioned. 4pp 1fig (BCA) Abstr. No. 1579/81

606

Tellier, C., M. Vouillemet, and J.J. Blanc

Work of the S.F.C. Study of the Drying Behaviour of Fine Ceramic Products

Ind. Ceram. (739) 324

In French. Accurate observations were made on dimensional changes during drying and water absorption, depending on method of fabrication. The rheology of test-pieces dried to different extents was studied to establish their ability to absorb stresses. Permissible humidity gradient limits calculated from Bigot curve and from mechanical properties agree with direct experimental results. Drying behaviour was related to materials composition. 3pp (BCA) Abstr. No. 4304/80

607

UOP, Inc.

Extruded Catalyst Composition

Patent No. Israeli IL 51063, 29 Feb, 1980, 24 pp. USA

A Co-Mo hydrodesulfurization catalyst for gas oils and residual fuel oils is prepared by mixing Al_2O_3 , a Co compound, Mo, and a peptizing agent (to produce a mixture characterized by a weight loss on ignition at 900 degrees of 50-70%), maintaining the mixture under shear-mixing conditions (the intensity of the shear-mixing being characterized by an energy input equivalent to 15-120 W/lb Al_2O_3 for 0.5-5 minutes, extruding the resulting dough, drying and calcining the extrudate, impregnating the calcined

extrudate with a Co compound and a Mo compound (so as to provide a final extruded composite comprising 1-10 weight % Co and 4-20 weight % Mo), and drying and calcining the product in an oxidizing atmosphere. (CAS) Abstr. No. CA93(26):242450j

608

UOP, Inc.

Extruded Catalyst with Improved Activity for Hydrodesulfurization of Residual Heating Oils

Patent No. Austrian AT 357511, 10 Jul, 1980, 10 pp.

USA

In German. The title catalysts, containing 1-10% Co or Ni and 4-30% Mo, are prepared by subjecting aqueous slurries of $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$ (bulk density 0.4-0.5) containing 10-40% of the required metal to shear mixing at 33-265 W-h/kg for 0.5-5 minute extruding drying, calcining, and impregnating with the remainder of the metals required. Thus, a catalyst containing 3.2% Co and 12.9% Mo is prepared by slurrying $\alpha\text{-Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$ and 75% of the required CoCO_3 and molybdic acid with sufficient 5% HNO_3 to give a slurry with ignition loss 55-60% at 900 degrees, which is subjected to intensive shear (68 W-h/kg) for 1 minute, extruded, dried, calcined 1 hour in air at 345 degrees and 2 hours at 595 degrees, combined with the required $\text{CO}(\text{NO}_3)_2$ (and molybdic acid in aqueous HN_3 , dried, and calcined at 78:22 air stream 1 hour at 330 degrees and in air 2 hours at 510 degrees. The catalyst has surface area 249 m^2/g , pore vol. 0.48 mL/g, pore diameter 72 angstroms and relative activity in hydrodesulfurization of vacuum gas oil (385 degrees/52 bar, space velocity 3.3/h) 146, compared with 279, 0.48, 71, and 106, respectively, for a similar catalyst prepared without intensive mixing. (CAS) Abstr. No. CA94(10):68463z

609

Vaucquelin, M., C. Gault, and P. Roch

Rheology of Clay Mixture Ceramic Bodies

1980 Documents

Ind. Ceram. (744), 736-40

France

In English and French. The determination of liquid limit (water concentration beyond which the material flows as a liquid) and plastic limit (water concentration under which the material loses its plasticity) from η -H and F-H dependences (η = viscosity, F = extrusion force, and H = moisture,) respectively, was used for evaluation of the plasticity of ceramic batches based on different clays and mixtures of clay with quartz, dolomite, feldspar, talc, and limestone. (CAS) Abstr. No. CA95(2):11334z

610

Vimini, C.

New Structural-Clay Products by Double Layer Extrusion

Ceramurgia 10(2), 378

In Italian. The method of manufacturing is described. The two clays must satisfy certain conditions of drying shrinkage, dilatometry,

composition and consequent chemical reactions. The properties of experimental products are listed and a visit to a Russian brickworks using this technique is briefly reported. 4pp 3fig (BCA) Abstr. No. 4213/80

611

Werkmeister, G.

The H,X-Diagram and its Application in Drying Technology

Ber. Dtsch. Keram. Ges. 57(4/5), GW1; (9/10), GW9

In German. The enthalpy humidity diagram and its applications are explained. 13pp 20fig 1tab (BCA) Abstr. No. 670/81

612

Zanghi, M.A.

Use of Wad Mill in Materials Handling

Ceram. Eng. Sci. Proc. 1(9/10), 812

Extruders for transforming the filtercake into suitable shapes for transport and for plastic shaping are described. (BCA) Abstr. No. 2695/81

1981 Documents

613

Balint, P., et al.

Equilibrium Moisture Diagrams for the Drying of Clays

Ceram. Int. 7(1), 35

With the aid of the desorption diagram the drying parameters required for obtaining the prescribed equilibria with respect to final moisture content of the dry product can be selected and the equilibrium moisture content obtainable at the given drying parameters can be determined. Examples given are three building clays, an illitic fine ceramic clay and a porcelain body. Adsorption depends on percentage and type of clay mineral. 4pp 4fig 2tab (BCA) Abstr. No. 4129/81

614

Bartusch, R., W. Schulle, and O. Krockel

Pore Volume Change and Volume Shrinkage of Extrusion-Molded Articles at Drying

Silikattechnik 32(4), 100

In German. Equations for calculating the pore volume portion in wet and dried ceramic articles and the volume shrinkage at drying were established. A close connection after drying between pore content and transverse strength of a china clay and an electrical porcelain body is demonstrated. 4pp 2fig 2tab (BCA) Abstr. No. 3941/81

615

Bekker, P.C.F.

Simple Clay Testing Methods

ZI Int. 33(9), 494

The rolling test, Pfefferkorn test, measuring of drying shrinkage and surface area measurement by moisture absorption are described for evaluating the plasticity of clay. The rolling test can be used to fix the Atterberg limits. These tests are complemented by the dilatometer curve obtained by firing to evaluate the suitability of a clay for brickmaking. 9pp 8fig (BCA) Abstr. No. 953/82

616

Chamorro, H.J.

Determination of the Minimum Yield Value of Clay-Water Systems in their Workability Range by Slow Compression of Small Cylinders

Bol. Soc. Esp. Ceram. Vidrio 20(5), 311

Spain

In Spanish. The minimum yield value Y_0 under shear stress was evaluated. The Y_0 values agree with those determined by extrusion. The minimum yield value is a particular property of the plastic state. Its value determines quite accurately the workability range of ceramic bodies. 3 pp 2fig (BCA) Abstr. No. 2049/82

617

Corapcioglu, M.Y.

Formation of Filter Cakes

Filtr. Sep. 18(4), 324

Formation of a filter cake resulting from accumulation of solid particles in a slurry is analyzed. The slurry is assumed to be a mixture of a liquid and solid grains. The conservation of mass equation is given for a compressible porous medium with an increasing depth due to continuous supply of slurry. The resulting equation is integrated along the thickness of the cake to obtain a time-dependent expression for cake thickness. An evaluation of the integral in the solution is given for a hypothetical simple case. 2pp 1fig (BCA) Abstr. No. 4519/81

618

Filippi, C.

Lamination in Clay Extrusion. Causes and Correction. Pt.4. The Auger and the Die to Prevent Laminations

Brick Clay Rec. 175(1), 32

A tight fit is required between auger and liner. Amount of clay extruded should be half the auger capacity. The length of the auger, die taper, cores and bridges, scoring devices, die lubrication and the choice between stiff and soft extrusion of bricks are discussed. 4pp (BCA) Abstr. No. 2138/81

1981 Documents

619

Havrda, J., V. Hanykyr, and L. Stehlik

Optimization of Ceramic Bodies Shaping on the Vacuum Auger Machine

Sklar Keram. 31(3), 57

The influence of the construction of the shaping aggregate on the course of shaping on the properties of the products was studied, using a high-alumina porcelain body. 6pp 11fig 8tab (BCA) Abstr. No. 3084/81

620

Havrda, J., and F. Oujiri

The Application of Diffusion Couple Method to Saturated Ceramic Bodies

Silikaty 25(3), 193

Transfer of water in a saturated ceramic mixture was investigated by making diffusion couples of two saturated ceramic bodies with different initial water content. Experimental conditions for reliable diffusion data were determined. The dependence of the diffusion coefficient on temperature was established. No correlation was found between D and the water content. 8pp 1fig 1tab (BCA) Abstr. No. 965/82

621

Hoch, K.E.

Influence of Vacuum Level and Pressing Power on the De-Airing Result During Extruding

Keram. Z. 33(3), 155

In German. The processes during evacuation of air in extruding presses are explained. It is deduced that increased pressure on the body before the vacuum chamber and better breaking up of the body has more effect on the evacuation result than a vacuum increase of 93-99%. 3pp 2fig (BCA) Abstr. No. 3087/81

622

Hoch, K.E.

The Influence of Vacuum on the Extrusion of Ceramic Bodies

Interceram 29(3), 390

To ensure that de-airing pugmills should produce a well de-aired ceramic product the following factors must be borne in mind. The pressure exerted on the body cushion in front of the vacuum chamber should not be too low. The higher the pressure the higher will be the compression of the enclosed air. This will facilitate escape of air from the shredded material pressure ore than would an increase in the vacuum from, e.g., 92% to 98%. The material entering the vacuum chamber must be shredded into pieces which are as small as possible. The vacuum should be as high as possible in the vacuum chamber since the pugmill again encloses air even if this is only at a pressure of 0.07 bar at 93% vacuum. 2pp (BCA) Abstr. No. 800/81

623

Hogue, C.H.

Living with Laminations

Brick Clay Rec. 178(4), 56

Aggregates reduce the tendency to laminate, but also reduce the plasticity. Sulphonates reestablish the plasticity for aggregate mixes. Calcium lignosulphonates without aggregate added seem to be the ultimate solution. 2pp 2fig (BCA) Abstr. No. 3520/81

624

Jaffe, J.

Comulled Silica-Alumina Base Denitrification Catalyst

Patent No. U.S. US 4289653, 15 Sep, 1981, 4 pp.

Cont. of U.S. Ser. No. 968,589, abandoned.

USA

An extruded silica-aluminum base catalyst was prepared by cogelling a silica sol solution containing Al and having pH 1-3. The cogelled silica-alumina is peptized to form an extrudable dough and may be mulled with Group VIB and Group VIII metals to prepare a denitrification catalyst extrudable compound. (CAS) Abstr. No. CA95(24):210496d

1981 Documents

625

Jiratova, K., and L. Janacek

Effect of Peptization on the Physical and Chemical Properties of Extruded Alumina

Chem. Prum. 31(4), 174-9

Czechoslovakia

In Czech. The factors influencing the $\text{Al}(\text{OH})_3$ peptization and its effect on the mechanical, surface, and chemical properties of the final Al_2O_3 extrudates were studied. The dependence of mechanical strength P of extrudates on the kneading time conforms to the first-order rate equation. The amount of the peptization agent needed to obtain a required P increases almost linearly with increasing size of the $\text{Al}(\text{OH})_3$ particles. The mechanical and physical properties of extrudates (P , specific surface area, and pore volume) depend on the value of the Hammett acidity function H_0 of the peptization agent used. The most significant changes were observed within 0 less than H_0 less than 1 for strong inorganic acids and 0 less than H_0 less than 3 for weak organic acids, whereas H_0 less than -0.25 results in unfavorable properties of extrudates. The anions of peptization agents which cannot be removed completely during the calcination procedure influence the acid-basic properties of the extrudate surfaces [the surface acidity increases in the series NO_3^- less than F^- less than SO_4^{2-} less than Cl^- .] (CAS) Abstr. No. CA94(26):214982m

626

Jye, C.T., and G. Brunello

The Mechanism of Drying of Clays--A Review

Ceramica (Sao Paulo) 27(143), 459

In Portuguese. Following a review of drying theories in general and on the basis of clay properties it is concluded that at usual temperatures the drying of clays can be mainly described by the theory of capillarity, while at higher temperatures, especially between 300 and 500 degrees C, by the theory of retrogression of the drying front. 7pp 4fig (BCA) Abstr. No. 2429/82

627

Kunes, K.

Application of Rheological Methods for Determination of Optimum Moisture Content in the Porcelain Body

Sklar Keram. 30(11), 297

Czechoslovakia

In Czech. The following tests were used: Robinder's penetration method, pressurized capillary viscometer and rotation viscometer. For determining the optimal moisture content for shaping by auger extrusion, the dynamic limit of flow and the plastic viscosity are most relevant. They are determined by the pressure and capillary viscometer. The investigation was to replace the plastic component. 5pp 8fig 3tab (BCA) Abstr. No. 1687/81

628

Lachman, I.M., R.D. Bagley, and R.M. Lewis

Thermal Expansion of Extruded Cordierite Ceramics

Am. Ceram. Soc. Bull. 60(2), 202-5

USA

Extruded cordierite [1302-88-1] honeycomb ceramics were developed as substrates for automotive exhaust catalysts. The honeycomb structure is made possible by a unique extrusion die design. The cordierite crystallites in the fired ceramics are preferentially oriented with the result that this structure has a markedly lower-than-average thermal expansion. Orientation results from the orientation of platy raw materials during extrusion. Chemical purity, stoichiometry, and firing rate also affect the thermal expansion. (CAS) Abstr. No. CA95(10):84982u

629

Lapasin, R., and E. Lucchini

Rheology of Clay/Kaolin Aqueous Suspensions and Ceramic Slips

Carlsson, R., and Karlsson, S.(eds.), Proc. 11th International Conf. on Science of Ceramics held at Stenurgrund, Sweden, June 14-17, 1981.

1981 Documents

Swedish Ceram. Soc., Gothenberg, Sweden, 1981, p. 91

The rheological properties of clay/kaolin aqueous suspensions and ceramic slips were studied by a rotational viscometer. A master curve procedure is followed to determine three rheological parameters. They are sufficient to characterize the shear-dependent behavior of the suspensions examined and to describe the effects of the different composition parameters on the rheology of the systems. 8pp 3tab 4fig (BCA) Abstr. No. 2736/82

630

Mitsche, R.T., and G.N. Pope

Reforming a Naphtha Feedstock

Patent No. U.S. US 4243515, 6 Jan, 1981, 6 pp.

Cont.-in-part of U. S. Ser. No. 880,749, abandoned

USA

A process for reforming a naphtha feedstock is described. The process is effected at reforming conditions in contact with a catalyst comprising a Pt group metal component and a Group IV-A metal component (Re, Ge) composited with an Al_2O_3 support wherein said support is prepared by admixing an $\alpha\text{-Al}_2\text{O}_3\cdot\text{H}_2\text{O}$ with an aqueous ammoniacal solution having a pH greater than or equal to 7.5 to form a stable suspension. A salt of a strong acid, e.g., Al_3NO_3 is commingled with the suspension to form an extrudable paste or dough. On extrusion, the extrudate is dried and calcined to form said Al_2O_3 . (CAS) Abstr. No. CA95(2):9730g

631

North, J.W.

Device and Methods for the Preparation of Cellular Glassy Products

Patent No. Neth. Appl. NL 80/20249, 1 Dec, 1981, 63 pp.

USA

In Dutch. Heat-resistant blocks or plates of cellular glass are prepared by extruding a siliceous mixture containing sucrose [57-50-1], covering

on 3 sides with a separating agent and glaze, firing, sintering at greater than 1093 degrees, and annealing. Thus, 1000 parts of clay (-6 mesh) from Fremont, California, 10 parts sucrose, and 110 parts water were mixed, formed into 30 cm^2 tiles 2.5 cm thick, sintered at 1095 degrees, and then at 1153 degrees for 0.5 hour to give a 40 cm^2 block of cellular glass. (CAS) Abstr. No. CA96(22):186162q

632

Okuda, S., et al.

Strain Distribution in a Plastic Green Body During Drying Observed by Holographic Interferometry

J. Ceram. Soc. Jpn. 89(102G), 101

Japan

In Japanese. Earthenware plastic masses were chosen as samples. Test specimens were prepared by inserting a rubber stopper in the central part of the plastic mass. The cracks resulting from drying strain always developed where a discontinuity or a local disturbance of the holographic interference fringes had appeared before and near the final stage of constant-rate period of drying. Holography is useful to predict locality as well as direction of cracks before they can be detected by the naked eye. 3pp 4fig (BCA) Abstr. No. 3342/81

633

Oller, S.

Rules and Principles for the Extrusion of Clays and Their Drying Behavior

Ceramica (Sao Paulo) 27(140), 319

In Portuguese. These fields are reviewed with particular reference to the amount of water required and the consequent energy consumption for drying. 11pp 5fig (BCA) Abstr. No. 385/82

634

Pivinskii, Yu.E., and P.L. Mityakin

Rheological and Binding Properties of High-Alumina Suspensions

1981 Documents

Refractories 22(5), 292

On the basis of a high-alumina chamotte composition, a highly concentrated suspension was obtained which makes it possible to mould casts of porosity to 16% and an ultimate bend strength of up to 4 MPa. The main principles in the process of making suspensions and the character of their rheological properties are similar to those obtained for siliceous suspensions. The casts of the high alumina composition are capable of being strengthened by the SCACB mechanisms, which makes it possible to obtain the casts of both fine-grained ceramics and materials of a grainy structure. 7pp 7fig (BCA) Abstr. No. 3303/82

635

Schafer, E.-E.

Use of a New Moisture Sensor in Drying Plant of Heavy-Clay Industry

Baustoffindustrie, Aug. A 24(5), 145

Germany

In German. For measuring humidity in air, a wet and dry thermometer was developed in which the temperatures are measured by resistance thermometers. Tests applied to various drying plants of a brick factory have shown correlations to exist between relative humidity of exhaust air and clay moisture content. Thus by measuring the humidity of air, drying can be stopped when clay moisture content has dropped to the required level. 2pp 6fig (BCA) Abstr. No. 949/82

636

Shershnev, A.A., et al.

Basic Parameters of Drying Kinetics for Porcelain Bodies

Glass Ceram. (Engl. Transl.) 38(7), 356

The drying rate of porcelain bodies was studied by recording the temperature of the drying agent, the temperatures on the surface and centre of the specimens and their moisture content. A relationship between the relative drying rate and the relative moisture content was established. 5pp 4fig 1tab (BCA) Abstr. No. 3537/82

637

Srivastava, L.K., and S.S. Wadhwa

Recent Trends in the Manufacture and Use of Extruded Clay Sewer Pipes

Indian Ceram. 23(12), 229

Present American, especially Canadian, practice is reviewed, covering all production stages: raw materials, clay preparation, extrusion of socket and spigot pipes, extrusion of plain-end pipes, drying and firing. The section on jointing with flexible joints includes both plain-end pipes and socket and spigot pipes. Energy requirements of 8 in. pipes made of various materials are quoted. 7pp 4fig (BCA) Abstr. No. 760/82

638

Steffens, E., et al.

Automated Production Line for Ceramic Extrusion Products

Silikattechnik 32(3), 73

In German. Stiff plastic extrusion was developed for making electrical porcelain and steatite, ferrite and magnesite ceramics. The cutting off is by high-pressure water jet. 1p 1fig (BCA) Abstr. No. 3089/81

639

Tischer, R.E.

Preparation of Bimodal Aluminas and Molybdena/Alumina Extrudates

J. Catal. 72(2), 255-65

USA

The methods used to produce bimodal pore structure in the extrudates were partial peptization, coextrusion of salt/boehmite mixtures and incorporation of combustible fiber such as Avicel [9004-34-6] or filter pulp. The study was limited to Conoco's Catapal SB Al_2O_3 . The effects of solid content of the mixture, pH of the peptizing solution, and degree of mixing on the consistency of the extrusion mixture and the pore-size distribution of the resulting extrudates were examined. The type of cellulose fiber and its loading affected the nature of the macropores produced in the extrudes. The extrudates were

1981 Documents

thermally treated to develop mesopores in the range needed for coal liquefaction catalysts (80-180 angstroms with an average pore diameter of

120 angstroms.) (CAS) Abstr. No. CA96(12):88246a

1982 Documents

640

Benev, A.

Improved Questions for the Approximative Calculation of Drying Kinetics of Heavy Clayware

Epitoanyag 34(2), 67

Hungary

In Hungarian. While previous approximative methods of calculation were valid only for thin-walled articles, the present improved equations predict the drying time of heavy-clay products with a maximum error of only 8%. 3pp 3fig (BCA) Abstr. No. 2182/82

641

Bubenicek, J.

Drying in the Ceramics Industry

Ind. Ceram. (762), 438, 439

In French and English. The adjustments of drying techniques in chamber, tunnel and rapid driers of the firm CERIC to the water content against relative humidity curves of ceramic bodies is discussed. The importance of automatic regulation for this purpose is emphasized. 5pp 5fig (BCA) Abstr. No. 3830/82

642

Gallacher, C.

Lignosulphonates--the Heavy Clay Conditioners

Ceram. Ind. (Sevres, France) 91(1031), 15

The chemical structure of the lignosulphonate molecule is presented. The effects of modified calcium lignosulphonates on the extrusion properties and on the binding of various types of clays are tabulated. Several faults of clay products and their remedying by modified calcium lignosulphonates are discussed: scumming, edge-chipping, auger lamination and dog-earing. These additives alone will not increase the tendency to black core or heart, except if the density was made too high. 8pp 2fig (BCA) Abstr. No. 2492/82

643

Gibson, K.R.

Hydrotreatment Catalyst Prepared with Large Pores

Patent No. Belg. BE 893160, 30 Aug, 1982; U.S. US Appl. 262856, 12 May, 1981; U.S. US Appl. 291588, 10 Aug, 1981, 24 pp.

USA

In French. Hydrotreatment, hydrodesulfurization, and hydrodemetallation catalysts with large surface to volume ratios and large pores were prepared by extruding Al_2O_3 -water paste into oval shapes with ridges. The interior of the catalyst shapes was less than or equal to 0.508 nm distance from the catalyst surface. Thus, a dispersion of 500 g Al_2O_3 in 300 mL diluted HCO_2H was heated to 50 degrees and treated with NH_4OH solution containing Mo salt. The resulting paste was extruded to give shapes of ridged oval cross-section. Slow drying and calcination in steam and then in air at 680 degrees completed the preparation. (CAS) Abstr. No. CA97(24):200563a

644

Guiu, J.M.G.

Stiff Extrusion in Structural Ceramics

ZI Int. 34(2), 118

The property requirements of the clay, its method of testing and clay preparation are discussed. Instructions are given concerning equipment and practice of stiff extrusion. 10pp 15fig (BCA) Abstr. No. 2497/82

645

Handle, F.

Shaping

ZI Int. 31(1), 14

The theory of extrusion, the reason for laminations and present vacuum extruders on the market are briefly reviewed. (BCA) Abstr. No. 2176/82

646

Janney, M.A.

1982 Documents

Plasticity of Ceramic Particulate Systems

Diss. Abstr. Int. B 43(3), 1935-B

Thesis: Univ. of Florida, 1982, 168 pp.

Ceramists have tried for many years to make technical ceramics such as alumina with plastic properties like those of wet clay. Some success has been achieved, but, little understanding of the mechanisms of plasticity in technical ceramics exists. The purpose of this dissertation was two-fold. The first was to study the mechanical behavior of alumina powder compacts saturated with liquid and compare this behavior with that for wet clay. The second was to determine whether the soil mechanics approach to particulate plasticity could be successfully applied to ceramic particulate systems. Standard soil mechanics test procedures were employed to determine pressure-volume relationships, response to combined states of isotropic and shear stress, and unconfined shear strength. In addition, some experiments were conducted in a piston extruder to study the role of pore fluid pressure in extrusion. The experimental study showed that the mechanical behavior of wet alumina was quite similar to that for wet clay. In consolidation, specific volume was proportional to $\ln$ (applied stress). The yield envelopes were generally of the Mohr-Coulomb with cap type. The unconfined strength, τ_{uf} , was influenced by both forming pressure, P_c , and specific volume, v : $\tau_{uf} = 0.125 P_c$; and $\ln \tau_{uf}$ proportional to v . Also, the unconfined strength of remolded specimens was one-third to one-tenth that of as-formed specimens. Critical state soil mechanics was used to analyze and interpret the data. The trends in unconfined strength are those predicted by critical state and quantitative agreement was observed between consolidation behavior and variation of unconfined strength with specific volume. Critical state theory was used to formulate a new phenomenological theory of extrusion. The theory predicts an extrusion equation which is identical to established empiricism in ceramics. Two broad conclusions can be drawn from this study. First, the mechanical behavior of wet alumina is similar

to that for wet clay. The differences that do exist are matters of degree, not kind. The nature of plasticity is the same in both systems. Second, critical state soil mechanics has been successfully applied to the variation of unconfined shear strength with forming pressure and specific volume, and to ceramic extrusion. The success of the soil mechanics approach for these simple systems suggests that it may prove useful for more complicated ceramic systems containing dispersants, binders, lubricants, etc. (Diss. Abstr. Order No. DA8226399)

647

Laquerbe, M.

Fabrication and Use of Cold-Stabilized Clay Products

Ind. Ceram. (759), 186-91

France

In French. The physical characteristics are given of an extrudable clay-cement mixture for the manufacture of building blocks requiring 50% less energy for firing. A pilot plant and experimental house built with the material are described, and the properties of blocks incorporating wood wastes are also described. (CAS) Abstr. No. CA97(20):167925v

648

Madderra, G.K., and W.C. Ziegenhain

Catalyst Impregnated Alumina Extrudates

Patent No. U.S. US 3933685, 20 Jan, 1976, 5 pp. USA

Catalysts for fixed-bed petroleum refining processes (e.g., hydrosulfurization, reforming, hydrodenitrogenation) are extruded as channeled cylinders to reduce particle interlocking and to increase voidage in beds. The cylindrical catalyst has greater or equal to 2 longitudinal channels, the walls of which occupy radii. Lands between channels have a maximum width greater than the maximum width of the channels. (CAS) Abstr. No. CA84(18):127214n

1982 Documents

649

Malandrino, Q.

Introduction to Ceramic Rheology

Ceram. Inf. 17(190), 12-27

Italy

In Italian and English. The principles of viscosity and its units were explained. This review then deals with the various types of Non-Newtonian fluids: plastic or Bingham fluids, pseudoplastic fluids, dilatant fluids and rheopexic fluids. The reasons for the above phenomena and their ceramic importance are discussed. A much more detailed treatment is given to thixotropy, because of its particular importance in ceramics, as explained. 15pp 12fig 1tab (BCA) Abstr. No. 2408/82

650

Messer, P.F.

Die Designs for Laboratory Use

Trans. J. Br. Ceram. Soc. 81(3), 66

United Kingdom

Novel design of plungers prevents stresses resulting from non-parallel platens. Applications of the design to the compaction of discs and rings is explained. 2pp 2fig (BCA) Abstr. No. 3124/82

651

Murray, H.

Dry Processing of Clay and Kaolin

Interceram 31(2), 108

Equipment for milling and classifying clay is described. Elimination of impurities during these operations is mentioned. Conditions of thermal treatment depend on product type: exterior pigment, refractory grog or Fuller's earth. 3pp 6fig (BCA) Abstr. No. 3128/82

652

Murray, H.

Equipment for Wet Processing of Clay Minerals

Interceram 31(3), 196

The subsequent stages of wet processing are described. Blunging, degritting, particle size separation, dewatering and drying are applied to all types of clays: china clay, ball clay, bentonite. Leaching of iron, flotation and magnetic separation are restricted to china clay. 2pp 3fig (BCA) Abstr. No. 3782/82

653

Netzmann, H., and F. Kerbe

Evaluation of Extrusion Behaviour of Stiff Plastic Ceramic Bodies by Shear Strength Measurement

Silikattechnik 33(2), 50

In German. The shear strength was measured by the method of Linseis which, itself, is based on extrusion. The rapidity of the test made it suitable for evaluating the optimum water and plasticizer content of ferrite bodies fabricated by extrusion. 2pp 2fig 2tab (BCA) Abstr. No. 2974/82

654

Oberlander, R.K.

The Extrusion of High Surface Area Aluminas for Use as Catalysts

Proc. Inst. Briquet. Agglom., Bienn. Conf., 1981, 17, pp. 247-62

USA

The effects of various preparation parameters on high surface alumina mechanical strength, attrition resistance, and pore structure were determined. A model of the effects of the extrusion process on these parameters is given for use in optimization and control. (CAS) Abstr. No. CA100(8):57361f

655

Rogovoi, M.I., D.I. Rudi, and D.I. Shvaika

Optimization of Screwless Extruder Operation

Stroit. Mater. (1)20

USSR

In Russian. The output of the screwless extruder was investigated, depending on the rotor's speed

1982 Documents

of rotation or the clay's plastic strength. 2pp 2fig (BCA) Abstr. No. 1742/82

656

Schmidt, K., and E. Steffens

Fully Automatic Production Line for the Preparation of Intermediate Products from Ceramic Bodies which are Difficult to Extrude.

Sprechsaal 114(12), 910

Germany, Fed. Rep.

In German. Equipment for the fully automatic extrusion of non-plastic bodies is described. This was used for electrical porcelain, fused magnesia, steatite, alumina, nickel-zinc ferrite and barium ferrite. 6pp 14fig 1tab (BCA) Abstr. No. 1393/82

657

Schmidt, K., and E. Steffens

Operating and Fields of Application of the Fully Automated Flow Line for Intermediate Products Made of Fine Ceramic, Sintered Ceramic, Oxide Ceramic and Other Materials Hard to Extrude

CFI, Ceram. Forum Int. 59(1), 51

The automatic production line described includes mixing of the ingredients, vacuum extrusion by auger and drying. Details on the water content and green density of the extruded electrical porcelains, steatites and ferrites are given. 8pp 13fig (BCA) Abstr. No. 2576/82

658

Sumitomo Metal Mining Co., Ltd.

Formed Alpha-Alumina as a Catalyst Support or Adsorbent

Patent No. Jpn. Kokai Tokkyo Koho JP 57/129824 (82/129824), 12 Aug, 1982, 5 pp.

Japan

In Japanese. Hydrated, active, or alpha-alumina is mixed with forming agents, formed at 20-120 (especially 65-120) kg/cm², crushed, formed again at 5-20 kg/cm², dried, and calcined at 1000-

300 degrees to have high specific surface area and wide pore diameter distribution. Thus, hydrated alumina (Condea Co., Alfor) 12 kg, bentonite 555 g, HNO₃ 75 ml, and water 6.2 l were kneaded, extruded at 100 and then at 10 kg/m², and calcined at 1150 degrees for 2 hours. The specific surface area was 55 m²/g, pore diameters less than 30, 30-300, and greater than 300 nm 53, 28, and 19%, respectively, and pore volume 0.32 ml/g, compared to 79 m²/g, 77, 21, and 2% and 0.30 ml/g when extruded at 60 and then at 10 kg/m² and calcined at 1100 degrees. (CAS) Abstr. No. CA98(2):8437s

659

Wadhwa, S.S., and L.K. Srivastava

Factors Affecting the Performance of Augers for Clay Extrusion and Their Remedial Measures

Interceram 31(3), 198

Following a brief description of auger extruders of the heavy-clay industry, the possible faults in the extruded column and their reasons are explained: lamination, surface and edge tearing, S-cracks, bridge or core cracking. The machine variables affecting the performance of auger extruders are then treated in turn. Constant displacement rate augers, variable displacement rate augers and gap augers are distinguished. The effect of auger rotation speed is briefly reviewed. The important functions of the barrel liner are pointed out. Choice between checkered, straight, fluted (spiral) and wedge groove liner depends on clay properties. These also affect the relationship between die construction and faults. The function of lubricating materials is mentioned. The good effects of de-airing and its limitations are described. Measures for controlling the adhesion of clay to the metal parts are listed. Feed versus auger speed affect lamination and backflow. Automatic methods of moisture control are mentioned. The advantages of stiff extrusion are explained. Preventive maintenance and replacement of machine parts are discussed. 6pp 6fig (BCA) Abstr. No. 3840/82

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660

Garcia Verduch, A.

Non-Plastic Additives for Heavy Clay Masses. Refuse Dumps of Puertollano (Spain)

Ceramurgia 13(6), 233-40, 251

Spain

In English and Italian. The addition of components to clay bodies to correct defects and improve the properties of products, facilitate fabrication processes, provide energy savings, and make use of abundant and cheap mineral resources is described and discussed. The use of ash materials from two types of dumps was investigated, the one containing residues from coal mining and also oil shale ashes, the other containing oil shale ashes that had undergone self-combustion. The ashes were finely ground before wet mixing with clay. All of the mixes were extrudable although the water content had to be adjusted for each mix. The drying shrinkage, plasticity index, Nosova index (drying sensitivity), slumping time in water, and flexural strength of dried and fired bodies were determined. The flexural strength of the ash-clay bodies was much higher than that of pure clay fired at the same temperature. In firing at high temperatures the flexural strength of the bodies reached a maximum at 1050-1100 degrees and then decreased. (CAS) Abstr. No. CA100(24):196650n

661

Huang, Y.Y.

Hollow Shaped Catalytic Extrudates

Patent No. Eur. Pat. Appl. EP 95851, 7 Dec 1983; U.S. US Appl. 383070, 28 May 1982, 44 pp.

USA

Tubular extruded catalysts or catalyst supports with high fracture resistance and crushing strength and a low tendency toward end blockage have a volume to surface ratio less than 0.51 mm and an outer surface which has greater or equal to 3 contact points when enclosed within a cylinder (rectangular and triangular shapes). The

extrudates are formed from aluminosilicates and zeolites with binder clays. Thus, a tubular catalyst was extruded from a composition of NaZSM-5 zeolite 65 and Al_2O_3 35 weight % mixed with H_2O and a cellulose-type extrusion aid in a hydraulic press through a die orifice, and dried at 105-121 degrees. (CAS) Abstr. No. CA100(8):57418e

662

Jiratova, K., L. Janacek, and P. Schneider

Influence of Aluminum Hydroxide Peptization on Physical Properties of Alumina Extrudates

Stud. Surf. Sci. Catal. 16(Prep. Catal. 3), 653-63
Czechoslovakia

Physical properties of alumina extrudates (catalyst supports) prepared from differently peptized $\text{Al}(\text{OH})_3$ were studied. The effect of different peptizing acids on the physical properties of extrudates can be generalized by using the Hammett acidity function H_0 of the peptization solution. In the range of 0 less than H_0 less than 1, the physical properties of extrudates change most significantly. The mean radii of transport pores were determined by combining the permeation and countercurrent diffusion measurements. A correlation was found between the mean radius of transport pores, calculated from diffusion measurements, and the volume of macropores. (CAS) Abstr. No. CA99(12):94373t

663

Stiles, A.B.

Catalyst Manufacture: Laboratory and Commercial Preparations

New York, NY: M. Dekker, 176 p.

USA

This book offers a single-source, step-by-step guide to the preparation, production, and operation of virtually all currently used commercial catalysts--a total of 16 catalyst "families" in all. Catalyst Manufacture specifies temperatures, times, materials, impurities to avoid, and more, to insure prompt design and production. It helps

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select appropriate procedures, from such numerous alternatives as precipitation, impregnation, spray drying, extruding, granulating, and pelletizing and supplies "do's and don'ts" guidelines, to avoid nonproductive development expense and delays. (from publisher's description)

664

Stoepler, W., and K.K. Unger

The Properties of Commercial Alumina Base Materials and Their Effect on the Manufacture of Active Porous Alumina Supports by Means of Extrusion

Stud. Surf. Sci. Catal. 16(Prep. Catal. (3)), 643-51

Germany, Fed. Rep.

The behavior of 60 commercial base aluminas (macrocrystalline nonporous gibbsites, microcrystalline nonporous and porous boehmites, thermally activated porous boehmites and gibbsites) was studied by paste processing and extrusion in order to produce active porous alumina pellets. The most decisive properties of the base materials with respect to extrusion are the degree of dehydration, the mean of aggregate size, the shape of aggregate size distributions, the shape of aggregates, the size of primary crystallites, and the specific surface area. The relevance of these properties to those of the final pellets (crushing strength, porosity, pore volume distribution and specific surface area) were examined. (CAS) Abstr. No. CA99(12):94372s

665

Thara, M.

Die for Extruding a Ceramic Batch into a Honeycomb Structural Body

Patent No. Can. CA 1146023 A1, 10 May, 1983; Jpn. Appl. 79/49219, 21 Apr, 1979, 17 pp.

Japan

Extrusion die for the forming of honeycomb shapes from a ceramic mixture manufactured from a tool steel is coated in front with electroless

Ni-(8-9%)P alloy [86805-65-3] for high resistance to abrasion. Thus, a steel die having narrow slits (formed by electrical-discharge machining) was coated with a Ni-P alloy for 495 minutes at 88 degrees to 0.09 mm thickness. The coating was heated 3 hours at 450 degrees for stabilization. (CAS) Abstr. No. CA99(12):92101d

666

Theodore, A.N., and R.A. Pett

Moldable Composition and Molded Bodies from It

Patent No. Eur. Pat. Appl. EP 74274, 16 Mar, 1983; U.S. US Appl. 300368, 300369, 300404, 8 Sep, 1981, 74 pp.

United Kingdom

Ceramic compositions, which are suitable for compression molding and continuous extrusion of tubing comprise a mixture of 40-60 sinterable beta-alumina precursor and 40-60 vol % of an organic sacrificial binder comprising a thermoplastic elastomer, an oil and/or wax emulsifier, stiffening polymers, processing aids, and optional components. Thus, 50.00 g powdered beta-alumina precursor consisting of Al_2O_3 90.4, soda 8.85, and Li_2O 0.75% were mixed with Solprene 414C 5.36, AgeRite Resin D [26780-96-1] 0.53, Sunoco Wax 3420 1.04, Sunoco Wax 4412 0.81, Styron 495 [100-42-5] 0.66, 6140-3 0.68, Plexon 845 0.43, Shellflex 371 1.47, and Flexricin P-4 [140-03-4] 0.94 g and molded, preheated, and sintered to plate-type electrolytes. Molding was carried out under pressure in 3 stages, terminating with a pressure of 9500 lb for 2.5 minutes. The binder was removed by heating at 12 degrees/h to 500 degrees, 50 degrees/h to 1050 degrees, and cooling at 50 degrees/h. The plates were sintered by heating at 62 degrees/h to 1590 degrees held 25 minutes, and cooled. The properties of the plates were similar to those of beta-alumina articles with less complex shapes and prepared by isostatic pressing and sintering. (CAS) Abstr. No. CA99(2):9817y

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667

Ackley, G.A., and J.S. Reed

Body Parameters Affecting Extrusion

Adv. Ceram. 9, 193-200

USA

The direct shear test, commonly used in soil mechanics, was used to measure the shear strength of a commercial electric porcelain extrusion body, under a controlled stress state. Changes in the shear strength caused by varying several material parameters were correlated with the extrusion pressure for the same body, determined by using a piston type extruder. The material parameters included water content, temperature, deflocculant concentration, and internal lubricant concentration. The extrusion pressure was found to have a linear dependent on the shear strength as measured by the direct shear test. The effects of the various material parameters were explained by using models for plastic flow. (CAS) Abstr. No. CA101(14):115560d

668

Furuta, M., Y. Maeno, and K. Kobayashi

Forming a Green Body of Ceramic Arc Tubes Used for a Metal Vapor Discharge Lamp and a Molding Die for Forming Said Tube

Patent No. U.S. US 4451418, 29 May, 1984, 7 pp.

Japan

Ceramic green integrally-shaped arc tubes, for metal vapor discharge lamps, having an arc discharge section of greater outer diameter than the end sections are prepared by extruding a stiff plastic ceramic body into a tube, placing the tube in a heated molding die, closing one end of the tubular body, and applying a compressed fluid through the other end to shape the tube to the die. The die consists of 2 halves divided in the axial plane of the tube with bents in the cavity section and a means of heating. The method gives arc tubes of high dimensional precision. Thus, a stiff plastic body was prepared from fine Al_2O_3 powders mixed with MgO 0.05, Y oxide

0.05, Me cellulose [9004-76-5] binder 3, polyethylene glycol [25322-68-3] lubricant 1, and water 25 weight %, extruded to a tubular shape, and immediately placed in the mold, which was heated at 150 degrees by an embedded heater. One end of the tube was sealed, and compressed air was used to inflate the tube to the mold dimensions. The formed tube was heated at 800 degrees for 3 hours and fired at 1800 degrees for 6 hours to give an Al_2O_3 ceramic tube having high dimensional precision, uniform wall thickness, a smooth surface, air leakage of 10-10 atom-cm³/s, and light transmission 93% and survive quenching in water from 200 degrees. (CAS) Abstr. No. CA101(12):96494s

669

Lachman, I.M.

Porosity in Extruded Cellular Ceramics

Adv. Ceram. 9, 201-11

USA

The relations between porosity and pore size of extruded cellular ceramics and variables including raw materials, processing, and composition were studied for cordierite, spinel, and ZrO_2 -spinel ceramics. The porosity and pore size are important properties for use of the ceramics as catalytic converters for automotive emission control, woodstove combustors, molten metal filters, heat exchangers, and catalytic combustors. In cordierite the mean pore size can be controlled very well by the particle size of the talc and SiO_2 raw materials as well as by the weight % of SiO_2 . The total variation observed was 4-18 mu. Eutectic melting had an important role in porosity formation. Firing temperature and heating rate were also shown to be variables and can be used to control the pore size in the range 4-17 mu. Spinel mean pore size was directly related to the particle size of the calcined alumina and basic Mg carbonate used, with 3-15 mu being the observed range. Percent open porosity was also a function of Al_2O_3 particle size. Firing-temperature increase coarsens the mean pore size and decreases the open porosity. The results for ZrO_2 -spinel reflect the effects seen with spi-

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nel. However, the introduction of relatively fine-particle-size ZrO_2 greatly reduces the mean pore size and the percent open porosity. The percent open porosity depended very much on the ZrO_2 -spinel ratio as well as amount, if any, of excess MgO or Al_2O_3 . (CAS) Abstr. No. CA101(16):135679c

670

McDaniel, C.V.

Extruded Bimodal Alumina Catalyst Supports

Patent No. Can. CA 1163614, 13 Mar, 1984; U.S. US Appl. 136221, 1 Apr, 1980, 27 pp.

USA

A partially dried, hydrous alumina [$\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}$, 1 less than or equal to 2] produced by reaction of Na aluminate with Al sulfate (intermediate between boemite and pseudoboemite) is mixed with H_2O to give 36-42 weight % total solids and then is milled sufficiently to give the desired plastic properties. The mixture is extruded, cut to desired lengths, dried at 482-649 degrees to less than 2 weight % H_2O content, and calcined at 954 degrees for 0.1-20 hours (at least several hours). The extrudates were impregnated with Co and Mo salt solutions and heated to give metal oxides. The catalysts had substantial micropore volume with large pores (greater than 600 angstroms, a crush strength greater than 1.5 lb/mm (1/16 diameter, extrudate), and a surface area 170-220 m^2/g . The catalysts were used for liquefaction desulfurization of coal. (CAS) Abstr. No. CA101(4):29141m

671

Reed, J.S., G.A. Ackley, and D.B. Price

Effect of Compressive Loading on the Structure and Yield Strength of a Porcelain Extrusion Body

Sci. Ceram. 12, 139-44

USA

The direct shear test was used to determine the plastic yield strength of a porcelain extrusion body under a compressive load. Pressures of 0-2.5 MPa increased the bulk density and plastic yield strength but reduced the liquid permeability. (CAS) Abstr. No. CA100(26):214423x

672

Yakubovich, M.N., V.I. Simontsev, and C.E. Vyt-nov, et al.

The Effect of Forming Methods on the Catalytic Properties of Catalyst Granules for Acrolein Oxidation to Acrylic Acid

Appl. Catal. 10(3), 297-302

USSR

The effect of forming methods of V-Mo oxide catalyst granules (for the oxidation of acrolein [107-02-81] to acrylic acid [79-10-7] by dry powder compaction and wet powder extrusion was studied with respect to catalytic properties and mechanical strength. An increase in the compaction pressure enhances catalyst mechanical strength but reduces activity due to diffusional limitations. The catalyst prepared by extrusion possesses reasonable mechanical strength and has a porous structure which prevents diffusional limitations. (CAS) Abstr. No. CA101(10):73129n

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