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MONTHLY REPORT, ANL CERMET DEVELOPMENT PROGRAM OCTOBER, 1965

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DATE November 3, 1965

TO D. R. de Halas

FROM D. W. Brite

SUBJECT MONTHLY REPORT, ANL CERMET DEVELOPMENT PROGRAM
OCTOBER, 1965

The following progress was made during the past month on the ANL Cermet Development Program:

Dissolution of Molybdenum Mandrels

The effect of wire diameter on dissolution rate was determined for the dissolution process reported last month, in which a stainless steel wire is inserted into the hole being formed by dissolution of the molybdenum mandrel to prevent vapor-locking of the hole, which results in precipitation of molybdic acid and plugging of the hole. Pyrex capillary tubing was selected into which 0.060" diameter molybdenum mandrels could be inserted with a minimum of clearance. Segments of the molybdenum mandrels were cut to 1/4" lengths (0.120 grams) and placed in the bottom of two-inch long, closed-bottom tubes made from the Pyrex tubing. Four-inch long pieces of Type 304 stainless steel wire of various diameters were placed in the tubes. The tubes were immersed in hot (85°C) acid solution of the composition 50 vol% HNO_3-30 vol% H_2SO_4-20 vol% H_2O for one hour, and the weight of undissolved molybdenum remaining in each tube was determined. The results, which are shown in Table I, revealed that the fastest dissolution rates occurred with wire diameters of 0.033 to 0.040". It is expected that the optimum wire diameter will be different for a different hole size.

TABLE I

EFFECT OF WIRE DIAMETER ON DISSOLUTION RATES

Wire Diameter, Inches	Final Mo Weight, Grams
0.016	0.031
0.020	0.024
0.024	0.061
0.033	0.015
0.035	0.017
0.040 (hollow tube, pointed end)	0.017
0.045 (hollow tube, flat end)	0.113

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D. R. de Halas

November 3, 1965

Procurement of Gadolinia-Stabilized Coated Particles

Vendor difficulties were reported in procuring 99.9% pure Gd_2O_3 to be used in preparing Gd_2O_3 stabilized W-coated UO_2 particles. The highest purity attainable was 99.7%. Since most of the impurities present were reported to be other rare earth elements, the vendor was notified that the 99.7% pure Gd_2O_3 would be acceptable.

As a result of a request made by ANL that the eight (8) cermet grids scheduled for fabrication at Battelle-Northwest utilize 66 vol% ceramic phase, in place of 45 vol% ceramic phase, as ordered initially, the vendor was instructed to change the W content of the coated particles to 34 to 40 vol%. The earliest shipping date the vendor can promise is December 20, 1965, which means that grid fabrication cannot begin until approximately the last week in December.

It should be noted that this increase in the per cent of ceramic phase, coupled with a corresponding decrease in web thickness and increase in hole diameter to keep the amount of fuel in the grid constant, will probably introduce a new set of fabrication problems, such as increased cracking tendencies, decreased strength, changes in hardware dimensions because of changes in hole diameter, and variations in the dimensional change in billets during pneumatic impaction due to differences in the starting density of the particles. Extensive hardware development following receipt of the coated particles cannot be accomplished under existing funds. Consequently, the exact grid dimensions obtained may be considerably off from the target dimensions. However, it is expected that the grids fabricated will be quite uniform when comparing one grid to another.

Fabrication of Special 1" x 1" x 0.040" Plates for ANL

A special request was received from ANL to fabricate several 1" x 1" x 0.040" cermet plates using W-coated Gd_2O_3 stabilized UO_2 particles supplied by ANL. A pneumatic impaction assembly was prepared, loaded with the special particles, and impacted at 1600°C and 265,000 psi. Ten (10) plates were produced. The impacted billet was annealed in hydrogen at 1700°C for three hours before dissolving the molybdenum can and spacers in nitric-sulfuric acid. The plates will be shipped to ANL at an early date.

DWB/af

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