CONFIDENTIAL

729942

R

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Cambridge
Massachusetts

September 30, 1942

This document contains information affecting the national defense of the United States within the meaning of the Espionage Act, 50 U.S.C., 31 and 32. Its transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

Professor C. C. Furnas
National Defense Research Committee
1703 32nd St., NW
Washington, D. C.

Dear Prof. Furnas:

Sometime ago we carried out a series of measurements on the thermal conductivity of a number of cakes of the salcomine absorbent prepared by the Rumford Chemical Company. These cakes were approximately 2-1/4" in diameter by 1-3/4" thick. The measurements were carried out in a steady state heat transfer arrangement and it is felt that the values are fairly accurate. The results of these measurements are tabulated in Table I. The first three samples were salcomine fines compressed to different specific gravities. You will note that the thermal conductivity increases somewhat at the higher density. The highest density of these three corresponds roughly to the Rumford "High-High" material. The next seven samples are similar cakes containing varying amounts of aluminum and bronze flakes. The increase in the thermal conductivity is not very great. In fact, with the exception of the cake containing 50 per cent aluminum, the values are almost the same as for the absorbent itself. The last three samples were made with copper powder and they do not show any particular advantage as far as the thermal conductivity is concerned.

It may be that higher thermal conductivities could be obtained if the metal were placed in such a manner as to be most useful in the direction of heat flow, such as metal threads lying in the direction of heat transfer. However, these values were obtained for solid cakes and the effect of such a directed path might be obliterated if random packed granules were used.

We have not studied the thermal conductivity of the packed granules very extensively. You will recall that we previously reported a value of 0.027 B.t.u.'s per hour per foot per °F. per foot square, based on an assumed heat capacity for the absorbent of 0.25 B.t.u.'s per lb. per °F. We have recently measured the heat capacity calorimetrically and obtained a value of 0.24 B.t.u.'s per lb. per °F. New measurements of the unsteady state heat transfer in the usual

CLASSIFICATION CANCELLED OR
CHANGED TO Unclassified
BY AUTH. CG DAR-1 4.3.1
BY David S. Ann DATE 4/1/96

1262407

1/2" tube packed with 10 to 20 mesh absorbent gave a value of the thermal conductivity of 0.0265. Similar measurements carried out in a 1" diameter tube gave a thermal conductivity of 0.0293. We feel that these are reasonable checks and should be suitable for heat transfer calculations. Measurements were also carried out in the 1/2" tube with 10 to 20 mesh granules of the absorbent containing 10 per cent aluminum. These experiments indicated a thermal conductivity of 0.05. It would appear that the addition of the aluminum was more beneficial for the granules than for the solid cakes. This seems rather unexpected and we do not have any satisfactory explanation. Actually I feel that the results for the granules containing aluminum must be high due to the fact that this material desorbs only slightly faster than the plain absorbent under comparable conditions.

In general, the results would indicate that there is no great advantage in the inclusion of a moderate amount of metals of high thermal conductivity as regards the solid cake. There may be an indication that the granules containing metal are slightly better than those without. However, the actual absorption results do not appear to be much different except in the case where a very large amount of metal is incorporated.

Yours very truly,

E. R. Gilliland

E. R. Gilliland

rl

cc: M. Calvin
H. Diehl
D. B. Curll, Jr.
W. Lobo
G. W. Roberts, Jr.
W. W. Beck
S. S. Prentiss
A. T. Larson
E. P. Stevenson
T. A. Geissman

1262408

Thermal Conductivities

Rumford Sample No.	Description	Compression Pressure LBS./IN.^{2}	Sp.Gr.	k*
#8	Salcomine fines	1,250	1.00	0.083
#9	" "	2,640	1.05	0.092
#10	" "	3,640	1.10	0.109
#1	" " + 2% Aluminum	3,640	1.11	0.112
#2	" " + 5% "	"	1.15	0.110
#3	" " + 10% "	"	1.23	0.116
#4	" " + 50% "	"	1.26	0.217
#5	" " + 2% Bronze	"	1.13	0.108
#6	" " + 5% "	"	1.13	0.101
#7	" " + 10% "	"	1.18	0.108
--	Salcomine + 2% Copper	---	1.11	0.095
--	" + 5% "	---	1.15	0.100
--	" + 10% "	---	1.17	0.100

*Thermal conductivity of solid cake - B.t.u./hr./ft./°F./ft.^{2}

1262409