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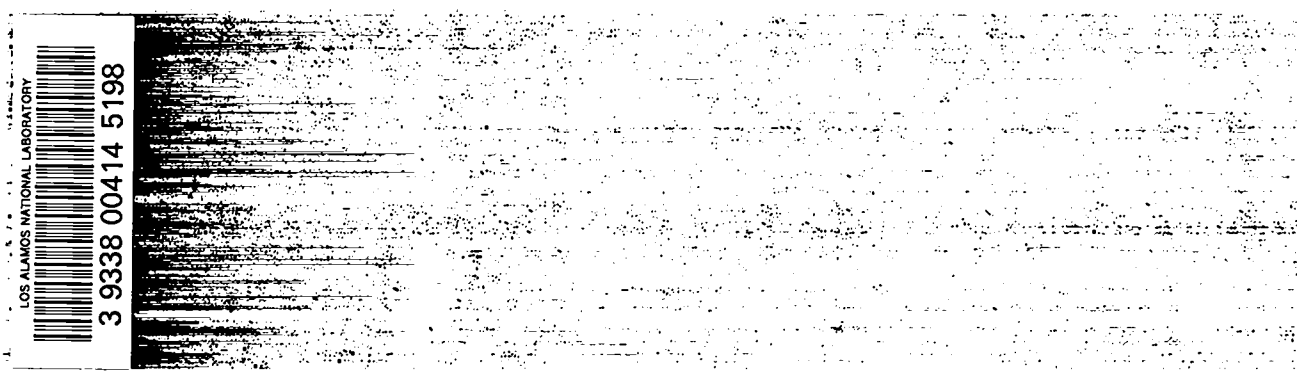

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October 16, 1943.

This document contains 6 pages

PREPARATION OF COMPACTS OF HIGH-DENSITY URANIUM HYDRIDE

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ABSTRACT

Compacts of uranium hydride having a density of about 10 or more have been prepared by allowing hydrogen to react with uranium metal which is enclosed in a strong steel vessel.

PREPARATION OF COMPACTS OF HIGH-DENSITY URANIUM HYDRIDE

The absolute density of uranium hydride has been reported to be 11.4. However the highest overall density which has thus far been obtained by compression of the powder is about 8. Uranium hydride of higher overall density has now been prepared by enclosing a sample of uranium metal in a steel capsule drilled with small holes for the admission of hydrogen.

The reaction temperature in these experiments was about 300°C., and the pressure of hydrogen was about 30 cm. The rate of reaction depended on the extent to which the capsule was filled and on the form of the uranium metal.

For the first experiment a capsule was made by drilling a 1/16" hole along the axis of a 1" long cylinder of 3/8" diameter untempered carbon steel. Onto the ends were screwed caps in one of which was drilled a #80 hole for the admission of hydrogen. (The cavity contained a 1" piece of approximately 1/16" diameter uranium rod.) The reaction was followed by measurement of the hydrogen in a calibrated system. In this case the reaction was allowed to proceed for about ten days. At the end of that time the capsule was removed and sawed in several sections whose diameters were measured with a Gaertner traveling microscope. The unreacted metal remained as a small core along the length of the cavity. The results of this experiment follow.

Original volume of cavity	0.0485 cc
Final expanded volume of cavity	0.0864
Number of gram atoms U in rod	0.00391
Number of gram atoms H absorbed	0.00938
% U reacted (on basis of UH_3)	80.1
Volume of unreacted U(d=19.3)	0.0096 cc
Volume of hydride	0.0768
Mass of hydride	0.753
Average density of hydride	9.8 gm/cc

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In an attempt to prepare hydride at higher density and in such a way that it could be removed in sizeable chunks, a capsule of different design was made (Fig. 1). The reaction in this vessel was slow and required about three weeks to reach 58% completion. Due to expansion of the vessel it was possible to unscrew only one of the caps. Several measurements of the diameter of the exposed hole were made. The conical plug was removed by sawing apart its steel container. As the three segments were separated the pyrophoric property of the hydride terminated the experiment. The density estimate is very rough since it is based on measurements of the diameter of the cavity at only one end. However examination of the hardened plug before and after removal from the steel container, and after removal of the hydride showed no evidence of variation in diameter along its length. The results of this experiment follow.

Final expanded volume of cavity	0.0625 cc
Number of gram atoms U in rod	0.00378
Number of gram atoms H absorbed	0.00654
% U reacted	57.6
Volume of unreacted U	0.0198 cc
Volume of hydride	0.0427 cc
Mass of hydride	0.525 gm
Average density of hydride	12.3 gm/cc

The final experiment was undertaken to achieve more rapid reaction and to obtain a larger sample. A 9/64" hole was drilled along the axis of a one-inch-long cylinder of 3/4 inch diameter untempered carbon steel. Caps, each drilled with five #79 holes (no more #80 drills) for hydrogen admission were screwed onto the ends. The cavity was packed with 12 one-inch-long 1/32 inch square-section uranium roads and one thin wire. The average initial density of the uranium in the entire cavity was 13.6. About 90% reaction occurred in four and one half days. One cap was unscrewed, the cylinder was sawed transversely in the center and measurements of the diameters at the exposed portion made. Under five-diameter magnification the mass appeared homogeneous. The results follow.

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Final expanded volume of cavity	0.336 cc
Number of gram atoms U in rods	0.01455
Number of gram atoms H reacted	0.0386
% U reacted	88.7
Volume of unreacted U	0.022 cc
Volume of hydride	0.314 cc
Mass of hydride	3.12 gm
Average density of hydride	9.9 gm/cc

Further work is being carried out by other members of this project.

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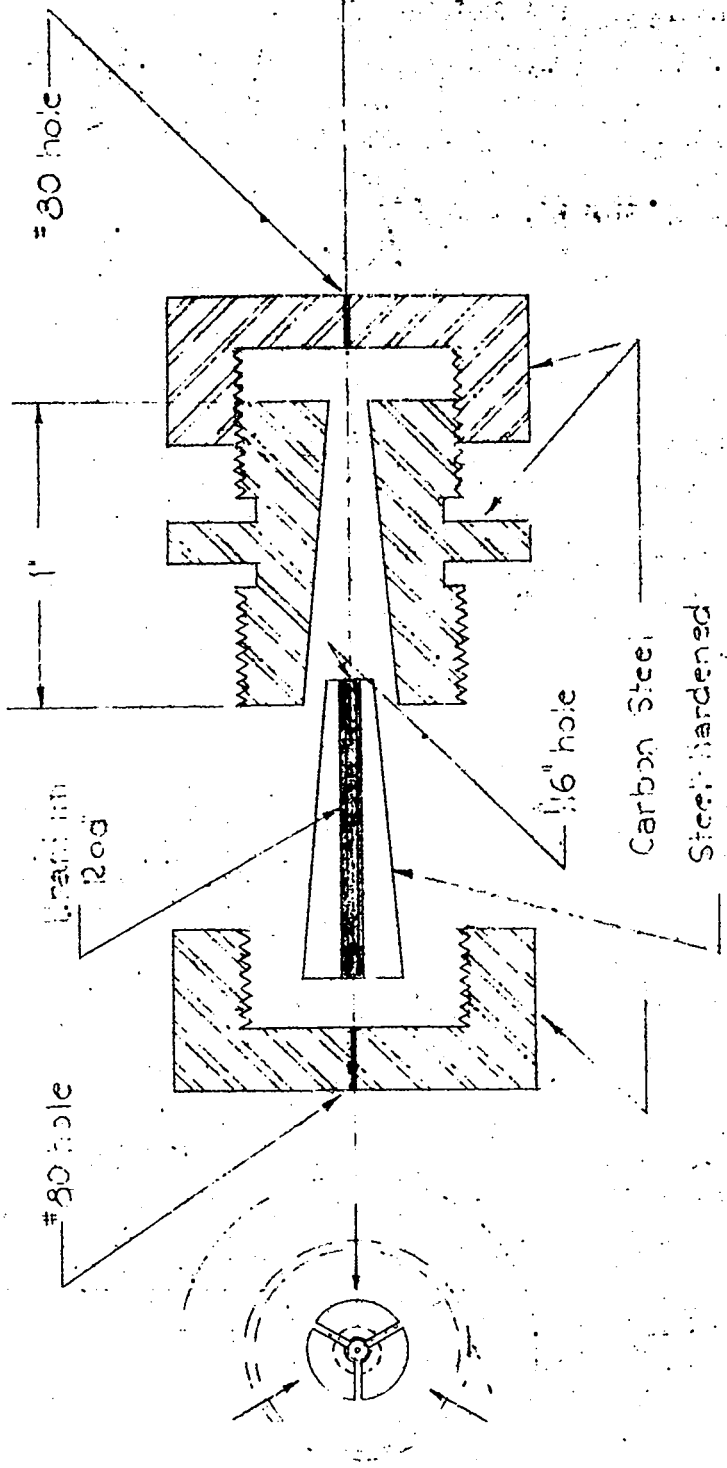

FIGURE 1

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