UNCLASSIFIED

[redacted]

L A REPORT 70

[redacted]

March 15, 1944

This document contains 5 pages

METALLURGY OF PLUTONIUM

WORK DONE BY:

L. Levinson

A. U. Seybolt

J. Zaring

REPORT WRITTEN BY:

A. U. Seybolt

[redacted]

[redacted]

This documen... the na-
tional defe... tes within the mean-
ing of ...onage Act ...0, 31 and 32, its
tra... or the revelation o... its in any
manner to an unauthorized person is pro... aw.

[redacted]

UNCLASSIFIED

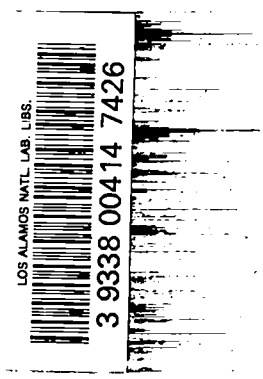
[redacted]

ABSTRACT

The hardness of a 20 milligram sample of lithium-reduced plutonium was found to be about 94 D.P.N. as compared to about 200 for unalloyed uranium.

An attempt to vacuum melt a 0.4 gram sample of calcium-reduced plutonium was unsuccessful, apparently because of the high vapor pressure of plutonium and its high melting point.

[redacted]



[redacted]

METALLURGY OF PLUTONIUM

HARDNESS AND MICROSTRUCTURE OF PLUTONIUM

A lithium-reduced centrifugal bomb reduction of 0.020 g of plutonium was mounted in lucite for metallographic examination and micro hardness tests. An average of four Eberbach micro hardness impressions gave a value of 94 D.P.N.; unalloyed uranium on the same scale is about 200 or higher.

Fig. 1 shows an unsatisfactory micrograph of the plutonium sample etched in one percent nital. There are apparently two phases present, but much more experimentation in polishing and etching techniques is required before a satisfactory metallographic presentation will be possible.

ATTEMPT TO VACUUM MELT PLUTONIUM

A one gram reduction of PuF_4 was made by the stationary bomb method with calcium as the reducer. The product was not consolidated well, but consisted of several small fragments of a metallic product weighing 0.4212 g. These pieces were placed in a BeO crucible which in turn was put in a tantalum heater crucible. A lid of BeO was used to cover the BeO crucible. The inside diameter of the BeO crucible was 0.15 inch and was about 5/8 inch high.

The crucible assembly was placed in the small vacuum furnace, and the power was turned on when the pressure read about two microns.

[redacted]

[redacted]

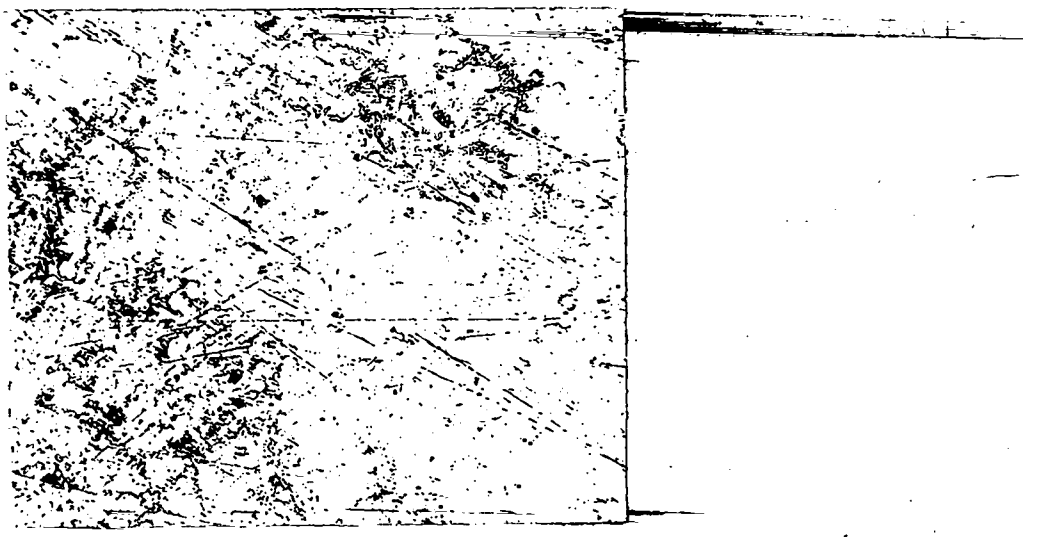
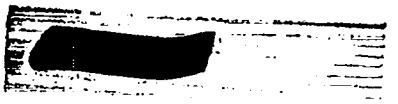


Fig. 1. Structure of 0.020 g plutonium sample reduced with lithium in the centrifugal bomb. Etched in 1 percent nital.

2396-1-2 x 250

[redacted]



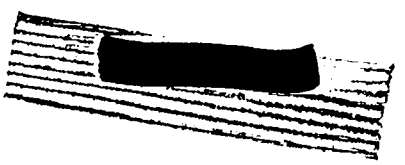
When the inner BeO crucible attained a temperature in the neighborhood of 1000° C, a black deposit began to form on the furnace walls. This deposit increased in amount as the temperature was raised. There is some doubt as to the actual maximum temperature attained because optical pyrometer readings could not be made. However, judging from past experience with the same furnace control settings, the temperature could not have been over 1500° C and was probably not much over 1400° C. When the furnace window became so black nothing could be seen inside, the power was shut off.

When the contents of the crucible were removed for examination, it was found that the pieces remaining had about the same appearance as before heating; there was no sign of melting. An alpha count of the window showed that there was about 0.1 milligram of plutonium there, indicating that the vapor pressure of plutonium may be too high for satisfactory vacuum melting. If the impurities present in the original charge were not such that they raised the melting point of plutonium considerably, it is likely that the melting point of the metal is above 1400° C.

After the melting attempt, the contents of the crucible weighed only 0.156 grams, indicating a loss of over 50 percent of the charge. At present it is uncertain what happened to the balance as the amount of plutonium recovered was only of the order of a milligram. It is probable, perhaps, that the impurity content of the original charge was quite high.

FUTURE WORK

The melting of the next plutonium reduction will probably be carried out in an atmosphere of argon.



[redacted]

UNCLASSIFIED

UNCLASSIFIED

[redacted]