

UNIVERSITY OF
CALIFORNIA

*Radiation
Laboratory*

TWO-WEEK LOAN COPY

*This is a Library Circulating Copy
which may be borrowed for two weeks.
For a personal retention copy, call
Tech. Info. Division, Ext. 5545*

BERKELEY, CALIFORNIA

UCRL-956
c2

DISCLAIMER

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor the Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or the Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or the Regents of the University of California.

UNIVERSITY OF CALIFORNIA

Radiation Laboratory

Contract No. 7405-W-eng-48

DECLASSIFIED

PROPERTIES OF THE ISOTOPE PU²⁴³.

S. G. Thompson, K. Street, Jr., A. Ghiorso, and F. L. Reynolds

November 6, 1950

~~CONFIDENTIAL~~

~~CAUTION~~ ~~DECLASSIFIED~~
This document contains information affecting the
National Defense of the United States.
Its transmission or the disclosure of its contents in
any manner to an unauthorized person is prohibited
and may result in severe criminal penalties under
applicable Federal Laws.

Berkeley, California

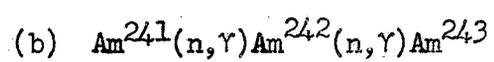
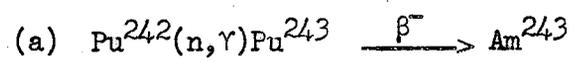
PROPERTIES OF THE ISOTOPE Pu²⁴³

S. G. Thompson, K. Street, Jr., A. Ghiorso, and F. L. Reynolds
Radiation Laboratory and Department of Chemistry
University of California, Berkeley, California

November 6, 1950

DECLASSIFIED

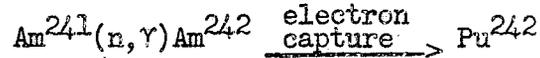
Investigation in this laboratory of the higher isotopes of plutonium produced by neutron irradiation has provided confirmation of the existence and properties of the new isotope Pu²⁴³ recently reported in this journal by Sullivan et al.¹ The work reported here was done using the extensively neutron irradiated plutonium samples previously described in this journal.² Following the irradiation, the plutonium, americium, and curium were separated from each other and from fission products and impurities. The relative amounts of plutonium, americium, and curium were measured and the isotopic compositions of the americium and plutonium were determined using a mass spectrograph. The ratio of the numbers of alpha-disintegrations from the isotopes Am²⁴² and Am²⁴³ was determined by chemical separation with measured yield of the beta-particle emitting daughters Np²³⁸ and Np²³⁹ and the measurement of their relative amounts by differential absorption methods using conventional Geiger counters as a means of detection. It was found that the ratio of Am²⁴³/Am²⁴² was higher by a factor of more than ten than in samples of Am²⁴¹ which had been subjected to comparable neutron irradiations. This result is interpreted to mean that essentially all of the Am²⁴³ was formed according to the reaction sequence (a) rather than (b).



The total amounts of the isotopes Pu²⁴² and Am²⁴³ found in the irradiated plutonium sample allow a calculation of the cross section for the reaction Pu²⁴²(n,γ)Pu²⁴³. This cross section was calculated as very roughly

10² barns using an estimated value for the neutron flux. The cross section is subject to a large error due to uncertainty in the estimation of the flux.

Subsequently, samples of plutonium of relatively large Pu²⁴² content were produced as indicated in part by the following reactions:



Samples of this plutonium were then irradiated with neutrons to produce the isotope Pu²⁴³. Following radiochemical purification of the plutonium, O'Kelley and Orth³ made a rough investigation of the radiations of Pu²⁴³ using a beta ray spectrograph and conventional absorption methods. They found the maximum energy of the beta particles to be 0.39 Mev and gamma ray energies of 0.095 Mev and 0.12 Mev, this confirming the beta particle energy of ~0.45 Mev measured by Sullivan et al.¹ The observed half-life of the radioactivity was 5.0 ± 0.2 hours and the amount of it corresponded roughly with the 10² barn cross section estimated above.

We wish to acknowledge the advice and assistance of Professor Glenn T. Seaborg whose help contributed greatly to the success of this work.

The successful handling in a safe manner of the radioactivity involved was made possible through the use of remote control equipment and excellent protective devices provided by Nelson Garden and the members of his Health Chemistry group. In this connection we especially wish to thank C. M. Gordon, W. G. Ruehle, and J. M. Davis for assistance during the experiments.

This work was performed under the auspices of the U. S. Atomic Energy Commission.

¹Sullivan, Pyle, Studier, Fields, and Manning, to be published.
(Submitted for declassification).

²Thompson, Street, Jr., Ghiorso, and Reynolds, Phys. Rev., in press.

³G. D. O'Kelley and D. A. Orth, private communication.

CONFIDENTIAL