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THERMAL NEUTRON FISSION OF Am241

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December 21, 1950

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THERMAL NEUTRON FISSION OF Am^{241}

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December 21, 1950

Measurements first performed in 1946 with microgram amounts of Am^{241} indicated a small but definite fission cross section with thermal (i.e., cadmium absorbable) neutrons. These earlier attempts to measure the cross section were inconclusive because of the small amounts of material available and the inadequate sensitivity of the fission pulse measuring apparatus. Upon the accumulation of larger amounts of Am^{241} and improvement of the fission counting apparatus[1] it became possible in 1947 to measure the cross section more accurately. Since the Am^{241} is produced as the decay product of Pu^{241} in pile plutonium it is associated initially with a relatively large amount of Pu^{239} and requires very stringent purification.

The purification procedure used by us consisted of the following steps: (a) separation of the bulk of the plutonium by precipitation with hydrogen peroxide from 1M nitric acid solution, leaving americium in the supernatant liquid; (b) separation of trace amounts of plutonium by oxidation[2] with argentic oxide to the hexapositive "fluoride soluble" state and precipitation of the americium with lanthanum fluoride carrier; and, (c) separation from lanthanum on a cation exchange column, using Dowex 50 and 0.25M citric acid-ammonium citrate solution[3] of pH 3.2.

Half-to-one microgram samples of the purified americium were spread as thin uniform deposits on one inch diameter platinum discs for fission measurements. These measurements were carried out in the thermal neutron column of the Argonne National Laboratories heavy-water-uranium pile at Chicago. The cross sections were measured relative to that of Pu^{239}. In

several instances samples were removed from the plates after the first measurements, repurified and remeasured. No significant differences in the apparent cross section were noted following repurification. The mean value of the cross section, as computed from several measurements, was 3.0 ± 0.2 barns, consistent within the experimental error of the measurements themselves.

We wish to express our appreciation to Dr. W. H. Zinn, who made available to us the facilities of the Argonne heavy water pile, and to Dr. W. M. Manning for permission to utilize the facilities of the Chemistry Division laboratories of the Argonne National Laboratory.

We are particularly grateful to Professor G. T. Seaborg for suggesting the problem and for his interest and advice in connection with the measurements. This work was done under the auspices of the AEC.

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[1] A. Ghiorso and W. C. Bentley, National Nuclear Energy Series, Plutonium Project Record, Vol. 14B, "The Transuranium Elements: Research Papers," Paper No. 22.29 (McGraw-Hill Book Co., Inc., New York, 1949).

[2] G. T. Seaborg and A. C. Wahl, J. Am. Chem. Soc. 70, 1128 (1948).

[3] K. Street, Jr. and G. T. Seaborg, J. Am. Chem. Soc. 72, 2790 (1950). The general technique of separation of actinide and lanthanide elements by cation exchange columns is discussed in this paper, but without specific reference to lanthanum-americium separations.