Some Short-lived Isotopes of Lanthanum

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Because of the difficulty of the rapid isolation of lanthanum from fission product of ^{235}U, the nuclear data on short-lived isotopes of lanthanum, the existence of which has been confirmed, have not yet been reported in detail. In a previous paper,[1] it has been shown that the isolation of lanthanum, cerium, and praseodymium was carried out within 4 min by electromigration at a selected concentration of nitrilotriacetate ions. The time taken for the isolation on lanthanum alone must be much shorter since there is a greater difference in the stabilities of the NTA complexes of lanthanum and cerium as compared with those of other adjacent lanthanide pairs. This method was applied to the rapid isolation of lanthanum isotopes, and some nuclear properties were measured.

A small amount (0.1 m*l*) of 10^{-2}M uranyl nitrate, irradiated for 1 min in KUR at the temperature of dry ice, was diluted by the carrier solution (3×10^{-4}M, 0.4 m*l*) in order to detect the migrating zone of lanthanum by studying color reaction with Arsenazo(III). Using NTA (3.7×10^{-4}M, pH=2.0), the separation was carried out by applying a potential gradient of 80 V/cm for 90 sec. Although this concentration of the ligand ion is lower than the optimum one for the separation of the La-Ce pair,[2] a high mobility is more feasible for separation from other fission products. After detection by color reaction, the γ-ray spectrum of the separated zone was measured with a CAMBERA Ge(Li) detector (30 cc). Starting 4.5 min after the end of irradiation, 20-sec countings were made at 30 sec intervals and each spectrum was recorded on a magnetic tape.

The first and third γ-ray spectra are reproduced in Fig. 1, in which two prominent photopeaks, at 0.395 and 0.541 MeV, may be found to have appreciably short lives. The decay plots of these peak areas are shown in Fig. 2. The half-lives obtained from three runs are given as 40 ± 2 sec for the peak at 0.395 MeV and as 43 ± 3 sec for that at 0.541 MeV. The two other photopeaks, at 0.619 and 0.644 MeV, observed in Fig. 1 were ascribed to the 14 min ^{143}La and the 92 min ^{142}La from their decay rates. No photopeak which should be assigned to particular nuclides of any element other than lanthanum one was found in this experiment.

For short-lived isotopes of lanthanum formed by

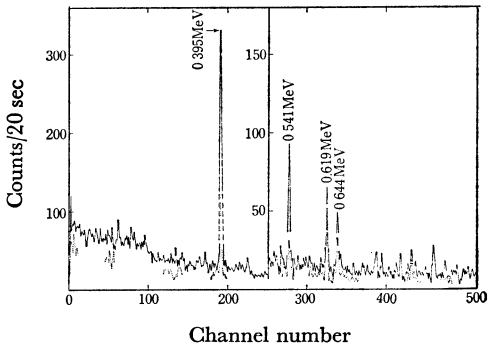

Fig. 1. γ-Ray spectra of La nuclides
—— 270 sec after the end of irradiation
------ 330 sec after the end of irradiation

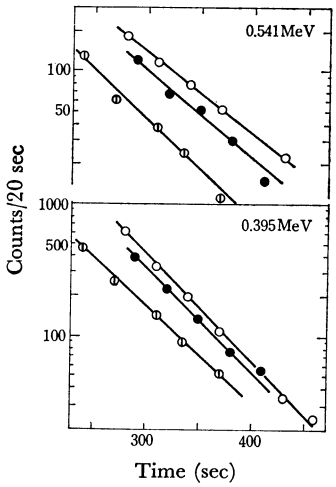

Fig. 2. Decay plots of photopeaks of La nuclide
Experiment No. 1 (○), No. 2 (●), No. 3 (◫)

fission, values of 92 min ^{142}La,[3] 14.0 min ^{143}La,[3] and 41 sec ^{144}La[4] are listed in the literature. For ^{142}La and ^{143}La, both the γ-ray energies and their abundances have been reported, but there have been no data for ^{144}La. As has been described above, a half-life of about 40 sec is given for both photopeaks at 0.395 and 0.541 MeV; therefore, we presumed that these two photopeaks could be attributed to the ^{144}La.

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2) E. Ohyoshi, This Bulletin, **44**, 423 (1971).

3) M. A. Wakat, "Nuclear Data Tables," Academic Press, New York, Vol. 8, pp. 509, 511 (1971).

4) I. Amarel, R. Bernas, R. Foucher, J. Jastrzebski, A. Johnson, J. Teillac, and H. Gauvin, *Phys. Lett.*, **24B**, 402 (1967).