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THE LANTHANUM AND CERIUM ISOTOPES OF MASS 137

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A sample of CeO_2 (Hilger Lab. No. 13356) was submitted to long neutron bombardment in a graphite-moderated pile. The activities were studied by the mass spectrographic transfer technique¹ and shown to consist principally of 30.6-day Ce^{141} , 1.4-day Ce^{143} , and 13.5-day Pr^{143} . After the sample had cooled for ten months its isotopic constitution was compared with that of normal cerium using the surface ionization type of mass spectrometer previously described². Normal cerium showed ion currents at masses 142, 154, 156, and 158, due to the oxide ions $Ce^{13}O^{16}$, $Ce^{138}O^{16}$, $Ce^{140}O^{16}$, and $Ce^{142}O^{16}$. In addition weak peaks were observed due to the two weaker oxygen isotopes. Pertinent impurities present were Ba, La, and Pr. The lanthanum and praseodymium were detected as $La^{139}O^{16}$ and $Pr^{141}O^{16}$, appearing at masses 155 and 157. The barium as metallic ions at masses 130 to 138.

The bombarded sample showed in addition to the above peaks a new peak at mass 151. That this peak is due to a new isotope of lanthanum was proved by considering and eliminating in turn all the other elements which might give rise to this peak. The fact that it was not cerium was proved by the fact that the ratio of the 152 to 153 peaks varied by a factor of 100

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as the temperature of the filament varied. Barium was eliminated because barium ions are emitted from a filament only as the metal, while lanthanum and cerium are emitted as oxides. It is thus concluded that the isotope observed at mass 137 is lanthanum. In the particular sample under investigation the ratio of La^{137} to La^{139} was 0.15.

From a consideration of the radioactive transfer and the amount of La^{137} observed it may be concluded that Ce^{137} has a half-life of less than two weeks. Since the isotopic composition of the barium impurity was not detectably changed as the result of decay of La^{137} , the half-life of La^{137} must be greater than thirty years.

References:

- 1) R. J. Hayden, and M. G. Inghram, Phys. Rev. 70, 89 (1946)
- 2) M. G. Inghram, R. J. Hayden, and I. C. Hase, Jr., Phys. Rev. 72, 967 (1947)