The electron energies and their interpretations are shown in Table I, while the gamma-energies are tabulated in Table II. By the use of a recording microphotometer the densities of the photographic plates, and hence, the relative intensities have been found for certain of the lines as shown in Table II. By utilizing the data and tables as presented[5] by Goldhaber and Sunyar, the multipolarity of certain of the transitions appears to be as shown in Fig. 2. One unusual feature of the 129.8-kev isomeric transition seems to be that the intensity of the L_3 conversion is about equal to that for the L_1 line.

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[1] Cork, Stoddard, Rutledge, Branyan, and LeBlanc, Phys. Rev. **77**, 843 (1950).
[2] R. D. Hill, Phys. Rev. **79**, 413 (1951).
[3] N. Hole, Arkiv Mat. Astr. Fys. **36A**, No. 9 (1948); G. Wilkinson, Phys. Rev. **75**, 1019 (1949).
[4] Steffen, Huber, and Humbel, Helv. Phys. Acta. **22**, 167 (1949).
[5] M. Goldhaber and A. Sunyar, Phys. Rev. **83**, 906 (1951).

Electrolysis of Thorium Oxide*

W. E. Danforth
Bartol Research Foundation, Franklin Institute, Swarthmore, Pennsylvania
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THE electrolysis of homogeneous crystalline thorium oxide at elevated temperatures is being studied. Fused material obtained from the Norton Company is red when received and will bleach when heated in vacuum or hydrogen. The red color can be restored by heating in oxygen and, under certain circumstances, by radiation.

Optically clear specimens are cut with a diamond saw, ground and polished, and are mounted in a vacuum furnace in such a manner that visual observation is possible during passage of current. Preliminary studies have been made with tungsten electrodes and with molybdenum electrodes, the results being the same in both cases.

When a current of 100 ma/cm^2 is passed at a temperature of 1300°C, a darkening of the crystal is observed to form at the cathode end and to proceed toward the anode at a rate of approximately one mm per second. The crystal in the photograph is 10 mm long. After 7 seconds with 100 ma/cm^2 (and a field strength of about 50 v/cm) the dark region extends approximately 7 mm from the cathode end. Attention is drawn to the appearance of a metallic deposit on the crystal surface at the cathode end.

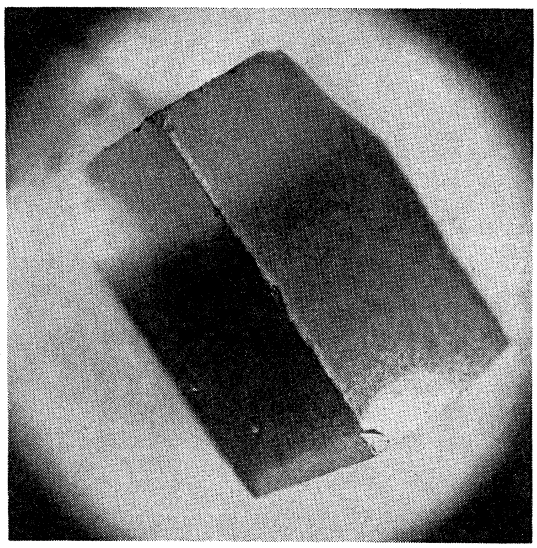

FIG. 1. A crystal of thorium oxide in an early stage of electrolysis.

When the drawing of current is continued the crystal becomes uniformly jet black and the metallic surface layer (presumably thorium) increases in area until it reaches the anode. This establishes an effective short circuit and electrolysis ceases.

If, starting with a specimen which has become completely covered with a metallic layer, one removes the layer by grinding, repolishes the crystal, and, subjects it to 1300°C for an hour or so, the black material diffuses to the surface and a metallic layer is again formed. It would appear, therefore, that the darkening is here associated with a stoichiometric excess of the metal, dispersed as ions, or possibly to some extent coagulated.

The particles responsible for the darkening are evidently charged since reversing the polarity of the applied field reverses the direction of motion of the dark region. However, wherever the dark region has reached the surface, a permanent discoloration remains. The charge responsible for the mobility appears to be neutralized (e.g., by stray electrons from outside) when the charge reaches the surface.

Certain evidence has led us to believe that the amount of thorium electrolyzed in the crystal in the photograph is not less than 10^{-2} mg. This is the result of the passage of 0.35 coulomb. If all the current were contributing to electrolysis, the quantity of thorium oxide electrolyzed by 0.35 coulomb would be 0.4 mg. This would indicate that, in single crystals, the fraction of current resulting in electrolysis is of the order of 10^{-2}.

It is of interest to compare the above result with that obtained from studies using finely divided thorium oxide. Measurements of the rate of disappearence of coated and sintered thoria cathodes show that the fraction of current producing electrolysis may be as low as 10^{-6}. The discrepancy may possibly be explained by a much higher electronic conduction in the activated cathodes than was present in the single crystals. It is also possible, however, that the large surface of the finely divided material plays an important part. The conductivity of the mass of particles may be of essentially different nature than that of a single crystal. Electrons in the surface region may possess higher mobility than in the interior. also it seems inescapable that metallic thorium will be liberated in the individual grains and migrate to their surfaces, giving rise to an even more involved electronic conductivity mechanism.

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Alpha-Particles from the Li^7+T Reactions

J. T. Dewan,* T. P. Pepper, K. W. Allen,† and E. Almqvist
Atomic Energy Project, National Research Council of Canada, Chalk River, Ontario, Canada
(Received March 20, 1952)

THE interaction of tritons with Li^7 [1] may lead to the following exothermic reactions:

$$Li^7+T\rightarrow He^6+He^4+9.79 \text{ Mev}, \quad (1)$$
$$Li^7+T\rightarrow He^4+He^4+n+n+8.85 \text{ Mev}, \quad (2)$$
$$Li^7+T\rightarrow Be^9+n+10.43 \text{ Mev}. \quad (3)$$

In addition, reaction (2) may proceed as a two-step process via the formation of the unstable nuclei Be^8 or He^5. This letter discusses the energy distribution of the α-particles from the first two reactions and reports evidence for a new excited state of He^6.

Hydrogen, 15 percent tritium, was accelerated to 240 kev and the mass-three beam magnetically selected to bombard a $Li_2{}^7SO_4$ target.[2] The charged particles emitted at 90° to the beam were studied with a 90° magnetic analyzer by the technique previously reported[3] and also with a large proportional counter. This counter consisted of a dural cylinder 5 inches in diameter and 15 inches long provided with a side window of mica 1 mg per cm^2 thick. The inner conductor was a 0.010-inch diameter tungsten wire which passed through glass insulators supported by guard rings at each end. The counter was filled with A containing 1 percent CO_2 to a pressure of 70 cm of mercury and was usually operated at 2400 volts. The gas multiplication was about five. Under these

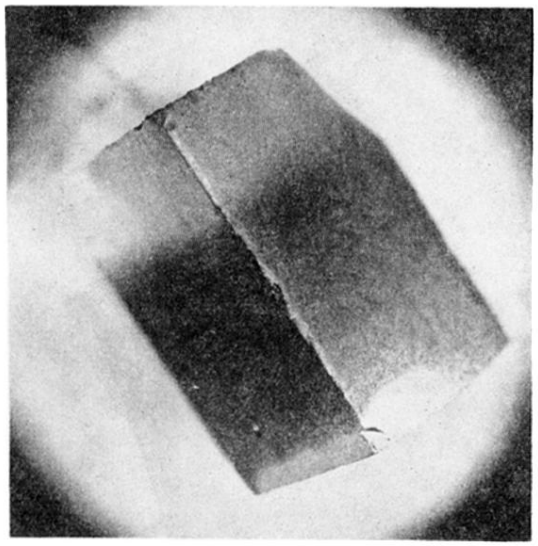

FIG. 1. A crystal of thorium oxide in an early stage of electrolysis.