Letters to the Editor

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NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 644.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

New Products of the Fission of the Thorium Nucleus

IN a preceding communication[1] it has been shown that the 'transuranium' elements are found among the fission products of uranium under neutron bombardment. Consequently they must be lower elements, probably partly somewhere near tellurium[2], partly (the complementary fission fragments) in the region of ruthenium.

It was then natural to carry out similar experiments with thorium in order to see whether the fission of thorium gave rise to elements with chemical properties similar to those of the 'transuranium' elements, that is, elements which can be precipitated with hydrogen sulphide from a strong hydrochloric acid solution. No search for such elements had previously been carried out with thorium, since the formation of elements beyond uranium, from thorium, was not to be expected. So far, chemical analysis of the radioactive bodies produced in thorium by neutron bombardment has revealed (apart from a thorium and a protactinium isotope resulting from pure neutron capture) only products which, on the basis of their chemical properties, had originally to be assigned to radium and actinium isotopes[3] and which have more recently been identified with barium and lanthanum isotopes[4].

A 'thick' layer of thorium oxide on a glass plate was irradiated by neutrons obtained by bombarding a lithium target with deuterons of 800 kv. from the high-tension equipment of the Institute of Theoretical Physics, Copenhagen. In order to collect the recoil nuclei, a water surface was used in the way previously described[1]. After irradiation (of about one hour) a fraction (2 c.c.) of the water was evaporated without chemical separation; with the rest (9 c.c.) the usual hydrogen sulphide precipitation was carried out in exactly the same way as in the uranium recoil experiments[1].

The precipitate showed a clearly measurable activity, the decay of which was distinctly different from the decay of the analogous uranium products. After an initial decrease with a half-value period of about 40 minutes, an activity remained which was followed for almost two days and showed a single decay period of 14–15 hours. The evaporated sample showed first a much faster decay which then gradually became slower; after two days, the activity had vanished.

A second experiment with 2·5 hours' irradiation gave the same result, with correspondingly greater intensity, especially of the longer period. In this experiment, after the sulphide precipitation, the filtrate was neutralized and the barium and lanthanum[1] were precipitated as carbonates. The carbonate precipitate decayed first with about 20 minutes and then with 4 hours half-value period, in agreement with the periods already known[3,4]. Analysis of the decay of the sulphide precipitate showed again the presence of a substance of half-period about 40 minutes and of one of 14·5 hours, which was followed for nearly three days and found to decay to zero. The initial intensities of the two periods were about equal, in spite of the short duration of bombardment. The possible existence of very short or very long additional periods can, of course, not be excluded on the basis of this experiment. The two periods observed are quite different from those of the chemically analogous uranium products.

Several check experiments without neutrons showed that there was no contamination of the water by thorium B or C, which might have resulted from radioactive recoil or traces of emanating thoron. As a further protective measure, the thorium layer was sealed, in the second experiment, by a celluloid membrane of 0·3 mm. stopping power.

From the evidence given above, one can conclude that some of the fission products of thorium show a chemical behaviour similar to that of the 'transuranium' elements. This is a further indication that essentially the same chemical elements are produced in the fission of uranium and thorium.

In conclusion, I wish to express my thanks to Dr. T. Bjerge, Dr. J. Koch, and K. J. Brostrøm for kind help in the irradiations with the high-tension tube. I am especially grateful to Prof. N. Bohr for the opportunity to carry out these experiments and for the facilities kindly put at my disposal at the Institute of Theoretical Physics, Copenhagen.

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March 26.

[1] Meitner, L., and Frisch, O. R., NATURE, **143**, 471 (1939).
[2] Abelson, P., *Phys. Rev.*, **55**, 418 (1939). Feather, N., and Bretscher, E., NATURE, **143**, 516 (1939).
[3] Meitner, L., Hahn, O., and Strassmann, F., *Phys., Z.* **109**, 538 (1938).
[4] Hahn, O., and Strassmann, F., *Naturwiss.*, **27**, 89 (1939).

Electronic Breakdown in Solid Dielectrics

IN a recent paper[1] Dr. Fröhlich has advanced a theory of the electronic breakdown of ionic crystals under electric stress. The theory was applicable to diatomic crystals such as the alkali halides, but an extension to any polar crystal (made at the instigation of the Electrical Research Association) is in course of publication by Dr. Fröhlich.

The E.R.A. has conducted a number of experiments in order to determine whether electric breakdown in a uniform field, brought about in a manner such that the breakdown is independent of external conditions, is of the electronic type envisaged by Dr. Fröhlich.