A New Radioactive Isotope of Potassium

In a previous communication[1] were reported results obtained in a study of the induced radioactivity of calcium. Decay curves of calcium metal which had been activated for many hours with neutrons from a beryllium target bombarded with deuterons were published, which showed the presence of a short-lived activity. This was not identified but it was pointed out that it might be due to a fast neutron disintegration. More recently[2] it was shown that there was some evidence for the reaction:

$$Ca^{42}+n^1\rightarrow K^{42};\quad K^{42}\rightarrow Ca^{42}+\bar{e},$$

though the resulting activity was weak.

The present note is a report of experiments on the radioactivity induced in calcium by irradiation with the highly energetic neutrons from a lithium target bombarded with 14 microamperes of deuterons. Samples of the metal and of a very pure specimen of $Ca(OH)_2$ were thus activated. The samples were contained in a cadmium box filled with boric oxide placed immediately behind the brass target plate. All showed the presence of two periods, one of half-life 12.5 hours, the other a short period of half-life 18 ± 1 minutes. The metal which was activated for several hours showed also the presence of a weak period of 76 ± 6 minutes which may be due to contamination as it was not observed with the very pure hydroxide.

Chemical analysis of the activities showed both the 18 minute and 12.5 hour period to be isotopes of potassium. The samples were dissolved in dilute HCl and inactive KCl was added. The calcium was precipitated as oxalate in alkaline solution. This was filtered off and found to be practically inactive. The potassium was precipitated by the addition of perchloric acid and ethyl alcohol. It was found to be radioactive and measurements on the decay showed the presence of both the short and the long periods. Magnetic analysis of the emitted radiations using a trochoid analyzer showed them to be negative electrons. Hence as the 12.5-hour period has been shown previously[2] to be due to K^{42} the 18-minute period must be associated with a heavier isotope of potassium either K^{43} or K^{44} formed thus:

$$Ca^{43,\,44}+n^1\rightarrow K^{43,\,44};\quad K^{43,\,44}\rightarrow Ca^{43,\,44}+\bar{e}.$$

The decay curves of an unseparated sample of $Ca(OH)_2$ and of a potassium precipitate from a second sample are shown in Figs. 1 and 2. For convenience only the early portions of the decay curve of the long period activity are shown. The decay of the K^{42} was actually followed for 28 hours.

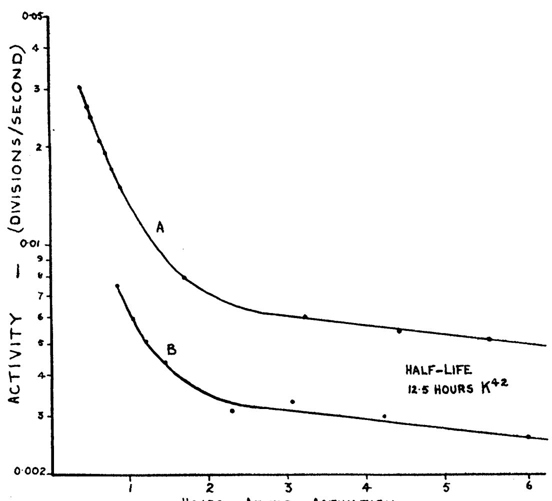

FIG. 1. Decay curves of very pure $Ca(OH)_2$ activated by $Li+H^2$ neutrons. *A*, potassium precipitate; *B*, unseparated sample.

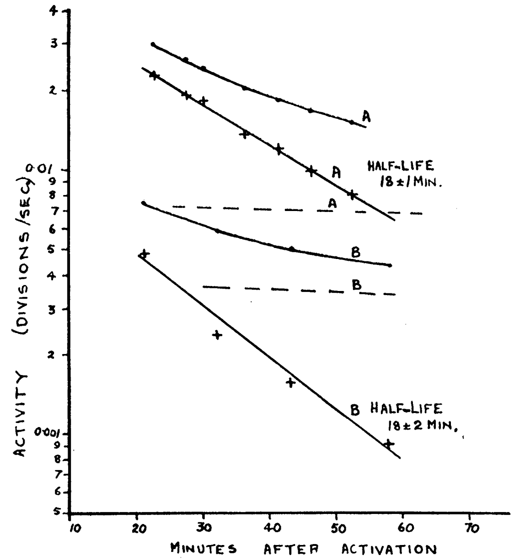

FIG. 2. Analysis of early portions of decay curves of Fig. 1. *A*, potassium precipitate; *B*, unseparated sample. Points indicated by dots; total activity; those marked with a plus sign have been corrected for the activity due to K^{42} which is shown by the dotted line.

No definite evidence was obtained of the very weak 4.5-minute positron period observed by Pool, Cork and Thornton[3] and ascribed by them to Ca^{39}. However, the samples used were activated for several hours and this period might well be masked by the increased activity due to the longer periods.

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1 Walke, Phys. Rev. **51**, 439 (1937).
2 Hurst and Walke, Phys. Rev. **51**, 1033 (1937).
3 Pool, Cork and Thornton, Phys. Rev. **52**, 239 (1937).
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