Letters to the Editor

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A New Type of Electrostatic Generator

P. H. MILLER, JR.
Randal Morgan Laboratory of Physics, University of Pennsylvania, Philadelphia, Pennsylvania
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AN attractive method of accelerating very high energy particles is the arrangement in cascade, as shown in Fig. 1, of several electrostatic generators whose charging current is provided by the decay of alpha particle emitting radioactive elements. Perhaps the most suitable element is $_{82}Po^{210}$ which emits alpha particles of 5.3-Mev energy while decaying to stable $_{82}Pb^{206}$. When the polonium is surrounded by an isolated metal shield, the emitted alpha particles will continue to reach the shield until it is charged to a potential equal to one-half the maximum kinetic energy of the alpha particles expressed in electron volts.

For a current of 25 μa and 2 Mev per stage, two conditions must be satisfied. If one-half of the emitted alpha particles is collected by the shield about 1 g of Po is required per stage. The second requirement restricts the loss of energy of the alpha particles in the polonium source to about 1 Mev so that the thickness of the active material on the inner sphere should not exceed about 4×10^{-5} cm.

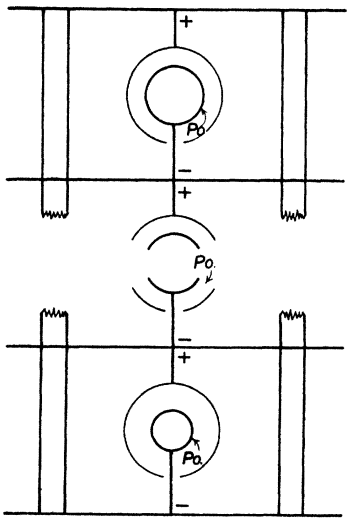

FIG. 1. Schematic drawing of electrostatic generator with several stages in cascade.

Thus the radius of the inner sphere must be bigger than 15 cm.

The cost of commercially available polonium prohibits the construction of such a device. However, it appears possible that polonium can be produced from bismuth in reasonable quantities by the following reaction:[1]

$$_{83}Bi^{209}+n^1\rightarrow{}_{83}Bi^{210}+\gamma$$
$$\sigma=0.023\times10^{-24}\ \text{cm}^{-2}\ \text{(thermal neutrons)}$$
$$_{83}Bi^{210}-(4.975d)\rightarrow{}_{84}Po^{210}+{}_{-1}e^{0}+1.17\ \text{Mev}.$$

It has been estimated[2] that if bismuth is used instead of water to cool a 10^6 kw chain reacting pile, 0.1 g a day can be produced. If a resonance for neutron capture exists, the rate of production will be enhanced.

The number of stages which can be placed in cascade depends on the supply of polonium available and design of the external insulating column.

[1] F. G. Houternams and I. Bartz, Naturwiss. **30**, 758 (1942).
[2] W. E. Stephens *et al.*, *Nuclear Fission and Atomic Energy*, Section 14.11 (to be published).

Absorption of Slow Neutrons by Cd^{113}

B. J. MOYER, B. PETERS, AND F. H. SCHMIDT
Radiation Laboratory, Department of Physics, University of California, Berkeley, California
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THE isotopes of cadmium were separated by a mass spectrograph and the absorption of thermal neutrons in Cd samples of different isotopic composition was studied.

Neutrons from a radium-beryllium source surrounded by paraffin were used in the measurements. Inside the paraffin was a glass bulb filled with $CdSO_4$ solutions. Indium foil detectors with and without cadmium shields were held in the center of the bulb.

The solution prepared from a sample of cadmium enriched in isotope 113 gave a cross section for absorption six times larger than a solution of equal concentration containing cadmium of normal isotopic composition. A mass spectrographic analysis of the sample enriched in Cd^{113} is in the process of being carried out.

The absorption in solutions containing cadmium enriched in Cd^{106}, Cd^{108}, Cd^{110}, Cd^{111}, Cd^{112}, Cd^{114} proved to be very small compared to the absorption in normal cadmium. The capture cross section for thermal neutrons in Cd^{116} is known to be small (1.4 barns).[1]

We conclude that the large absorption cross section of cadmium[2] for thermal neutrons is caused by resonance capture in Cd^{113} (whose natural abundance is 12.3 percent) and that none of the other cadmium isotopes make any appreciable contribution.

The above work was carried out under the auspices of the Manhattan District. We are indebted to Professor E. Segrè for valuable advice.

[1] 1.4×10^{-24} cm^2.
[2] H. A. Bethe, Rev. Mod. Phys. **9**, 151 (1937).