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Radioactive Products of High Energy Deuteron Bombardment of Cu

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April 19, 1948

Serber[1] has suggested inelastic collisions in which only a fraction of the available energy is lost as the initial step in the formation of nuclei by high energy particle bombardment. The nucleus thus excited subsequently boils off particles and energy. This theory differs from that of the compound nucleus, which holds at low energies, in that the incident particle is not captured. Serber's theory has been applied with success to several cases[2]. The characteristic feature of the excitation function is the large value of cross-section at high energies (~5 times the threshhold) relative to that predicted by the theory of the compound nucleus. The formation of atomic number Z + 1 from target of atomic number Z cannot proceed by this process since it requires the capture of a proton although another possibility would be an exchange collision between incident proton and a neutron.

The excitation functions of a number of radioactive species from the bombardment of Cu with 190 Mev deuterons have been measured. Chemical separation of a number of fractions including Zn, Cu, Co and Ni were performed. The Zn^{63} and Zn^{62} activities which must be formed as mentioned above show maxima at less than 50 Mev, and steady decreases to the highest energy measured (140 Mev) where the values are less than 1/5 those of the maxima. This is in accord with considerations of the compound nucleus. However, Ni and Co activities show maxima at low energies, minima, and subsequent increases at higher energies, such as are characteristic of Serber's theory.

This work is based on work performed under contract W-7405-eng-48 with the Atomic Energy Commission in connection with the Radiation Laboratory, University of California, Berkeley, California.

(1) R. Serber. Phys. Rev. 72, 1114, 1947.

(2) R. L. Thornton, R. W. Senseman. Phys. Rev. 72, 872, 1947.
W. W. Chupp, E. M. McMillan. Phys. Rev. 72, 873, 1947.

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