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A STUDY OF THE DEPTH-DISTRIBUTION OF CARBON IN STEEL USING THE (d,n) NUCLEAR REACTION

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When a target is bombarded with deuterons, the nuclear reaction (d,n) is likely to occur. In such a case the final kinetic energy of the outgoing neutrons will depend on the primary deuteron energy, the Q-value of the (d,n) reaction, the angle of observation of the neutrons and the energy loss of the primary deuterons in the target material before the reaction takes place. If thus the reaction neutrons from a monoenergetic deuteron beam is studied under a fixed angle, the energy variation of the neutrons will in principal reflect the depth distribution of the different elements in the target. Due to the large differences of Q-values for different elements the neutron spectra from these elements can in many cases be separated. This method for studying depth distributions is particularily suitable for light elements (for example C, O and N) where the level density is low. If moderate deuteron energies are used ($\sim$3 MeV) the neutron background from the heavier backing material is usually comparatively low.

The above indicated method has been used to study the depth distribution of carbon in a steel target down to a depth of about 20 μm. Our experimental conditions allowed us to work with a depth resolution of between 0.5 to 1.0 μm. The sensitivity was in all cases better than 0.01 weight per cent of carbon deposited on the target surface.