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Investigation of Chromium-55

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The decay of Cr-55 has been investigated by Bazorgan and co-workers¹ and by Flammersfeld and Herr.² They found a half-life of ~3.6 m, beta radiation of ~2.8 Mev maximum energy, and no gamma radiation. They also found a thermal neutron activation cross section for its production from stable Cr-54 of ~0.4 barn. It seemed desirable to check the mass assignment, half-life, and particularly the possibility of gammas in the decay scheme. This last was of importance to the Nuclear Analyses Group (ORNL) because they determine vanadium by gamma counting of V⁵² which has a similar half-life.

To confirm the mass assignment and half-life, samples of chromium enriched to varying degrees in Cr-54 were bombarded in the ORNL graphite reactor. The 3.6-minute beta activity was found to be produced approximately in proportion to the Cr-54 content.

Some gamma radiation was detected as a result of these irradiations. To determine the source of this radiation, the following experiment was performed: A sample of high-purity chromium metal was analyzed for vanadium by a standard radioactivation method. This consisted of irradiating vanadium metal and chromium metal and comparing the short-lived gamma activities produced (by scintillation

¹ G. A. Bazorgan, J. W. Irvine, Jr., C. D. Coryell, Phys. Rev. 95, 781 (1954).

² A. Flammersfeld, W. Herr, Z. Naturforsch. 7a, 649 (1952).

counting). It was concluded that 0.6 ppm of vanadium in the chromium could account for the observed gamma activity. V-52 could also be produced by the reaction $\text{Cr}^{52}(\text{n},\text{p})\text{V}^{52}$.

An upper limit was placed on gammas associated with Cr-55 by comparing the gammas observed by counting on a scintillation counter with the expected beta activity produced in the graphite reactor, assuming 0.4 barn for the cross section. The efficiency of the counter was taken to be $\geq 25\%$, applicable to gamma radiation of energy 0.1 - 1 Mev. This value was found to be 0.01%. Since this gamma activity probably was due to vanadium impurity, an upper limit of $< 0.01\%$ for gamma associated with Cr-55 decay seems reasonable.

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