MEASUREMENTS OF RADIOACTIVITY FROM ALUMINUM AFTER IRRADIATION BY ^{40}Ar AT 150 MeV/u

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The Faraday bars in the coupled cyclotron facility s A1900 analysis system are beam stops during radioactive ion beam production. These will become significantly radioactive, potentially representing a source of significant personnel exposure during maintenance. Predicting radioactivity and exposure levels requires the knowledge of the radionuclides produced and their abundances. We therefore bombarded a thick target of aluminum, of the type used in the Faraday bars, with a high-energy heavy ion.

A pellet of aluminum, type 1100, was place in a beam of $^{40}Ar^{16+}$ ions at 150A MeV. The pellet thickness was about 1 cm, which was sufficiently thick to stop the beam. The pellet was placed in electrical contact with a Hevimet thick target/Faraday cup system used for thick-target neutron yield experiments. The beam current, about 1 enA, could then be integrated. The pellet was irradiated for 24 hours, then removed and after one hour placed in front of a Victoreen Model 450B ionization chamber, to measure exposure rate as a function of time for 3 days. After this, the pellet was placed in front of a high purity germanium photon detector, and the produced radioisotopes were identified.

The identified radioisotopes and their activities, calculated for the time when the irradiation ceased, are shown in Figure 1.

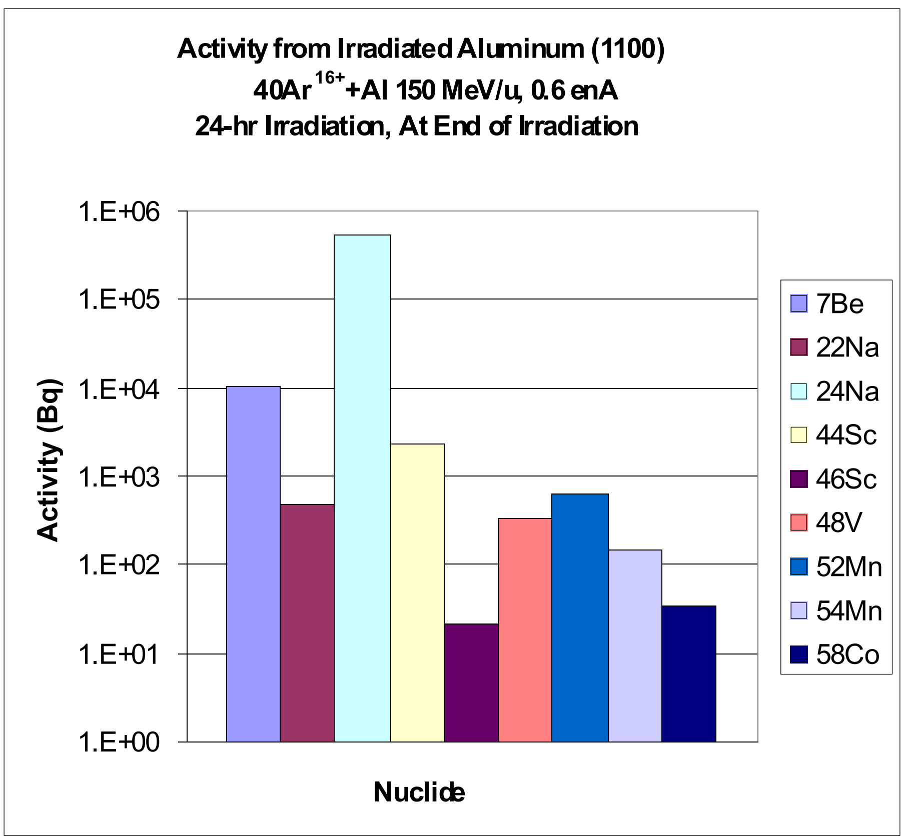

Figure 1: Activities of radioisotopes that were observed after the irradiation of type 1100 aluminum by a beam of 150A MeV ^{40}Ar ions. The activities are calculated for the time when the irradiation ceased.

The pellet material, identified isotopes and quantities, and the pellet-to-ionization chamber distance were used as inputs to the point-kernel photon shielding code MicroShield [1]. The cooling curve for the activated pellet was predicted and compared to the measurements. The measured values of exposure after one and two days were larger than the predicted ones by about a factor of two. However, the ratio of measured to calculated values of the exposure after two days compared to the value of this ratio after one day (about 0.3), agrees very well, indicating that the Faraday bar radioactivity cooling can be reasonably well predicted.

References

1. Computer code *MicroShield*, version 5.05, Grove Engineering Corporation, 1700 Rockville Pike, Suite 525, Rockville, MD 20852.