Fission Product Yield Measurements of Pu-239 Irradiated at the USGS TRIGA Reactor

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Abstract:

Fission product yields of the major actinides are essential for a wide range of nuclear applications. For instance, these nuclear observables are used to calculate the heat production in nuclear reactors, to generate computational models that monitor the nuclear stockpile, and to measure forensic signatures following detonation of a nuclear weapon. The relative uncertainties for current measurements reported impede the accuracy on these nuclear applications; therefore, more fission product yield measurements are required for proper nuclear data evaluation. Efforts aim to improve these measurements to better understand the energy-dependence of fission product yields. Specifically, the yield of valley nuclides (A ~ 120) is particularly sensitive to the energy of the incident neutron and provide the greatest insight towards the energy-dependence of the fissioning nucleus. Integral fission yield measurements were completed on the USGS TRIGA reactor at the Denver Federal Center located in Denver, CO. Two separate PuO_2 targets were individually irradiated in the Central Thimble, with one of the targets fully wrapped in a cadmium shield during irradiation. These experiments were designed to evaluate the behavior of a fissioning Pu-239 nucleus under a thermal and hardened neutron spectrum. Following irradiation, each PuO_2 target was individually dissolved and select fission products throughout the Pu-239 mass distribution curve were radiochemically isolated for beta- and gamma-analysis. This poster will summarize the significant radiochemical stages and feature the yields measured from Sr, Mo, Zr, Cd, Ag, Cs, Ba, and Nd fission products for both the bare and Cd-wrapped irradiation, and these experimental results will be compared against currently reported measurements.