Zr Nuclear Data Campaign: Measurement of (n, γ) cross section of ^{90}Zr

J. M. Brown[1], K. H. Guber[1]

C. Paradela[2], P. Schillebeeckx[2], S. Kopecky[2]

[1]Nuclear Data Group, Oak Ridge National Laboratory, PO Box 2008, Oak Ridge, TN 37831, USA
[2]Nuclear Physics Unit, EC-JRC-Geel, Retieseweg 111, 2440 Geel, Belgium

The isotopes of Zr with $A = [90, 91, 92, 94]$ make up more than 97% of naturally occurring Zr [1] and are important to many nuclear applications such as nuclear reactors. One of the attractive qualities of naturally occurring Zr isotopes is that they have a low σ_γ/σ_t ratio at most neutron energies, such that they improve the neutron economy in reactors by preferentially scattering neutrons rather than absorbing them. This same quality also presents a challenge to measuring the capture cross section, σ_γ, of Zr isotopes. The ENDF/B-VIII.0 library has a relative uncertainty of approximately 10-20% for incident neutron energies < 0.1 MeV, and uncertainty greater than 20% for energies > 0.1 MeV for the majority of natural Zr isotopes. This motivated the Nuclear Criticality Safety Program (NCSP) to embark on a campaign to accurately measure and evaluate these isotopes of Zr. Here we will show energy-dependent neutron capture cross section measurements for the first enriched sample to be measured: ^{90}Zr.

The measurements of isotopically enriched samples are being carried out at the Geel Electron Linear Accelerator (GELINA) facility of the Joint Research Center - Geel (JRC-Geel) of the European Union. As isotopic enrichment is a costly process we are careful not to activate any of the samples, as this may hinder future radiation-sensitive measurements. The activation analysis is presented in a report by Brown et al. [2]. Once we were satisfied that the Zr samples would not be activated by the measurements, the ^{90}Zr sample was fabricated at Oak Ridge National Laboratory (ORNL) and shipped to GELINA. The dimensions of the cylindrical sample are approximately 0.12 cm thick and a radius of 2.5 cm. Since ^{90}Zr is not chemically reactive to air, bare metallic samples were employed. The sample was measured at a flight path (FP) length of 60 m, using four C_6D_6 detectors on FP14.

The final paper will include experimental details and measured cross section data for ^{90}Zr compared to current evaluated nuclear data libraries. [1]

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References

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