International Nuclear Physics Conference INPC2013: 2-7 June 2013, Firenze, Italy

Measurement of ^{136}Ce, ^{156}Dy and ^{168}Yb Thermal Neutron Capture Cross Sections

Jeong-Yeon Lee[1], Yeongduk Kim[1], Gwang-Min Sun[2]

[1] *Department of Physics, Sejong University, Seoul 143-747, Korea*
[2] *Korea Atomic Energy Research Institute, Daejeon 305-353, Korea*

Contact email: *yeon@sejong.ac.kr*

For several low abundance stable nuclei, the thermal neutron capture cross sections are not well measured, while the cross sections for isotopes with high abundances are already well measured. Especially, the cross sections of the thermal neutron capture reactions on ^{136}Ce, ^{156}Dy, and ^{168}Yb are poorly measured, though the capture cross section data play essential roles in determining neutron capture cross sections over wide energy regions in nuclear data evaluations.

Our experiments, different from the commonly used method of using gold foil as reference, are performed using natural foils for which we know the relative abundances of all isotopes and thermal neutron capture cross sections. Therefore, we can obtain the cross sections of low abundance isotopes, which are not known well, by comparing the yields of gammas from the neutron captures by various isotopes in the foils. The advantage of this method is the cancellation of potential systematic errors from thermal neutron flux, flux profile, foil thickness, foil size, and irradiation time.

To measure thermal neutron capture cross sections, we used the high thermal neutron flux from the research reactor HANARO at Korea Atomic Energy Research Institute. We irradiated the natural Ce, Dy, and Yb foils (99.9 % pure) in the neutron irradiation facility for 6.0 h, 8.5 h, and 3.0 h, respectively, considering the neutron capture cross sections of the natural isotopes in the natural foils, material sizes, and gamma intensities and activations after neutron captures. And we measured the gammas from the irradiated Ce, Yb, and Dy foils with a Be-windowed HPGe detector located at KAERI.

We could measure the thermal neutron capture cross sections of ^{136}Ce, ^{156}Dy, and ^{168}Yb by comparison with the activity measurements of their reference isotopes ^{140}Ce, ^{164}Dy, and ^{174}Yb and obtained new cross section values of 7.64±0.63 barn for ^{136}Ce, 14.38±1.94 barn for ^{156}Dy, and 1346.1±32.0 barn for ^{168}Yb.