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[P01] 241Am Neutron Capture Cross Section Measurement and Resonance Analysis

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Advanced nuclear systems are expected to use Pu-containing nuclear fuel alongside Minor Actindes (MAs). Accelerator-Driven System (ADS) is a proposed sub-critical advanced nuclear system to lessen the current amount of MAs by means of nuclear transmutation into short-lived or even stable nuclei. The effect of the current nuclear data uncertainty to the criticality assessment of ADS facilities has been quantified in recent studies, including the effect of the neutron capture cross section in the keV region [1]. 241Am (t1/2 = 432 yr) is one of the most profuse MAs present in spent nuclear fuel. A preliminary ADS nuclear transmutation study has been performed assuming the MA isotope concentration of 20.72% for 241Am in the core, the second highest after 237Np. Current JENDL-4.0 uncertainties for the neutron capture cross section of 241Am are larger than 12%, much larger than the requirements of below 5% in the energy range from 0.454 keV to 1.35 MeV [2]. In addition, 241Am is continuously produced in the nuclear fuel of advanced reactors, as they comprise Pu, due to the β-decay of 241Pu (t1/2 = 14.4 yr). Hence, an accurate characterization of the neutron capture cross section is of paramount for the design of advanced nuclear systems. Neutron capture cross section measurements were performed in the Accurate Neutron Nucleus Reaction Measurement Instrument (ANNRI) at the Materials and Life Science Facility (MLF) of the Japan Proton Accelerator Research Complex (J-PARC). The time-of-flight (TOF) methodology was employed in a non-filter condition experiment to determine the neutron capture cross section from thermal to about 100 eV. Moreover, experiments were performed using the neutron filtering system to determine the neutron capture cross section at the energy of 23.5 keV using Fe as filter material[3]. A sample of 241Am with a mass of 7.5 mg was used for the measurements with an activity of 950 MBq. The neutron spectrum was reconstructed using the 478 keV gamma-rays from the 10B(n, αγ)7Li reaction with a boron sample containing enriched 10B up to 90% in the no-filter condition. In this study, the preliminary results of the 241Am neutron capture cross section from 10 meV to about 100 eV determined in TOF experiments and at 23.5 keV from Fe filter experiments are presented. In the TOF experiments, the 241Am neutron capture cross section was normalized by means of the saturated resonance method using a Au sample with a mass of 1.5 g. In addition, for the Fe filter experiments, the capture cross section of 241Am at the energy of 23.5 keV was determined relative to the 197Au yield obtained from a measurement using the same Au sample. Moreover, early-stage results of a resonance analysis of the 241Am capture resonances are also presented.

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[2] M. Salvatores and R. Jacqmin, vol. 26, no. NEA/WPEC-26. 2008.

[3] G. Rovira et al., Nucl. Instruments Methods Phys. Res. Sect. A Accel. Spectrometers, Detect. Assoc. Equip., vol. 1003, no. April, p. 165318, 2021.

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