Contribution ID: **29** Type: **not specified**

One-proton Removal Cross Section of ^{90}Sr Using a Thick Solid Deuteron Target/厚い固体重水素標的を用いた^{90}Sr の 1 陽子剥離断面積

Thursday, 20 November 2025 16:45 (1h 25m)

In Accelerator-Driven systems (ADS), reliable cross-section data for fast neutron interacting with radioactive waste are essential for improving the prediction accuracy of transmutation performance [1]. Due to the high radiotoxicity of the waste, it is difficult to use it directly as a target; therefore, a neutron target is desired. However, the fabrication of a stable neutron target is not feasible. A recent theoretical study suggests that neutron reaction cross sections can be indirectly extracted by combining those measured with deuteron and proton targets [2]. There¬fore, a deuteron target has the potential to provide such data and is important. We are develop¬ing a thick solid deuterium target (SDT) for reaction cross-section measurements. Thick targets are advantageous for these measurements, as they improve statistical uncertainty and reduce measurement time due to the increased number of reactions within the target.
By further developing the existing solid hydrogen target production system [3], we fabricated a thick, large-aperture SDT with a length of 50 mm and a diameter of 50 mm. To check the system, we performed an ion beam irradiation experiment using the SDT.
The experiment was carried out at the BigRIPS beamline of RIKEN RIBF. A primary ^{238}U beam at 345 MeV/u was incident on a ^{9}Be production target to produce a cocktail beam that included ^{90}Sr at 235 MeV/u via projectile-fission reactions. The sec¬ondary beam was irradiated onto the SDT, which was located at the entrance of the ZeroDegree spectrometer (ZDS). The time of flight (TOF) was measured by two plastic scintillation coun¬ters. The magnetic rigidity ($B\rho$) was determined by the trajectory reconstruction using the positions and angels of particles measured by parallel-plate avalanche counters (PPACs) in¬stalled at each focal plane. The energy loss (ΔE) was measured by an ionization chamber. The particles in both upstream and downstream of the SDT were identified event by event via the TOF–$B\rho$-ΔE method. In this study, we evaluated the performance of our SDT system by comparing the one-proton removal cross sections of ^{90}Sr with the data reported in Ref. [4]. We will report the experimental setup and the results.

References

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Session Classification: Poster Session / ポスターセッション