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# Study on 35Cl(n, p) Reactions Using Sample-Added Scintillator/試料添加シンチレーターを用いた 35Cl(n, p) 反応の研究

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The cross sections of neutron-induced charged-particle emission reactions such as (n,p) and (n,α) for many nuclides have not been measured as well as those of the neutron capture reaction. In the present work, building upon our previous confirmation of the feasibility of the sample-added scintillator technique for detecting neutron-induced charged-particle emission reactions, we plan to extend this approach to a specific target nucleus, 35Cl. The aim is to measure the 35Cl(n, p) reactions with improved accuracy by a new kind of method. The new method uses plastic scintillator added with sample material for measurement which is a cube with a length of 60 mm. The sample-added scintillator attached on a photomultiplier tube (PMT), which PMT is placed at 90 degrees to the neutron beam, is irradiated with neutrons and charged-particles emitted from neutron-induced reactions are detected at the same time. In order to collect as much photon as possible from the scintillator, a device is used to reflect the light onto the surface of the PMT. Scintillators including sample materials were fabricated and the fabricated scintillators will be tested in irradiation test experiments conducted with the Pelletron of the Institute of Science Tokyo. Boron nitride (BN), lithium fluoride (LiF), gold (Au) and lithium chloride (LiCl) were chosen as sample materials to mix with scintillator for the test experiments. The 10B(n,α)7Li, 6Li(n,t)4He, 197Au(n, $\gamma$)198Au and 35Cl(n, p)35S reactions occur in scintillators added with BN, LiF, Au and LiCl respectively. The cross sections of the reactions are high and the Q-values are also high. Thus, charged particles from the reactions are easy to detect and these reactions are good for test. To identify charged particles, the pulse shape discrimination (PSD) was also employed. The pulse shape discrimination technique is based on the property of organic scintillators that the decay constant of light output changes depending on the mass and charge of charged particles. Signals from the photomultiplier tube were fed into the CAEN waveform digitizer V1720 that enables us to process signal onboard for the PSD parameter. In addition to the PSD parameter, the time-of-flight and the pulse heights of events were recorded sequentially. We have already simulated different sample-added scintillators using PHITS. From the simulation results, we can distinguish different charged particles successfully. Therefore, we can use this method to identify the proton produced by 35Cl(n, p)35S in the future experiment. The present contribution will report the results of the PHITS result.

References

[1] S. A. Kuvin , H. Y. Lee , Nonstatistical fluctuations in the 35Cl(n, p)35S reaction cross section at fast-neutron energies from 0.6 to 6 MeV, Physical Review C 102, 024623 (2020).
[2] E. Sansarbayar , Yu. M. Gledenov et al., Cross sections for the 35Cl(n, α)32P reaction in the 3.3–5.3 MeV neutron energy region, Physical Review C 104, 044620 (2021).
[3] E. Sansarbayar , Yu. M. Gledenov, Erratum: Cross sections for the 35Cl(n, α)32P reaction in the 3.3–5.3 MeV neutron energy region [Phys. Rev. C 104, 044620 (2021)], Physical Review C, 105, 049902(E) (2022).
[4] Y. Shinjo, T. Kin, A. Nohtomi, Advancement of plastic scintillator made with 3D printer, Ionizing Radiation, 46, 39-48 (2020).

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