

Study of keV-Range Neutron-Capture Cross Sections of Chromium Isotopes/クロム同位体の keV 中性子捕 獲断面積の研究

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Chromium (Cr) matters from two perspectives. In reactors, Cr is a major alloying element in stainless steels throughout cores and internals. Its 1–100 keV neutron-capture cross section directly affects reaction rates and k_{eff} [1]. In astrophysics, accurate MACS are crucial for modeling nucleosynthesis [2]. However, current datasets and evaluations show discrepancies in this energy window, so high accuracy with small uncertainties cross section of Chromium is needed.

We plan to carry out measurements of the neutron capture cross section ^{50}Cr and ^{53}Cr at the Institute of Science Tokyo. Neutrons are produced via the $^7\text{Li}(p, n)^7\text{Be}$ reaction by bombarding a lithium target with a proton beam from the Pelletron accelerator. Prompt γ -rays from the neutron capture reactions are detected with a NaI(Tl) detector. The incident neutrons are monitored with a ^6Li glass detector and the incident neutron energy is determined with the time-of-flight (TOF) method. Measurements are conducted in the two energy regions: 15–100 keV and around 550 keV. The flight paths from the neutron source to the sample are 120 mm for the low energy experiment and 200 mm for the high energy one. The NaI(Tl) detector is shielded with multiple shielding materials to reduced γ -ray and neutron backgrounds. The NaI(Tl) scintillator is surrounded with an anti-Compton annular detector to reduce the Compton-scattering events in the detector. The TOF and the pulse-height of events are recorded sequentially in the list-format data. After background subtraction, the pulse-height weighting technique is applied to derive the neutron capture yield from the pulse height spectrum. The cross section is obtained in ratio to the $^{197}\text{Au}(n, \gamma)^{198}\text{Au}$ reaction. The result is normalized to the standard cross section of $^{197}\text{Au}(n, \gamma)^{198}\text{Au}$.

The plan and feasibility of the present study will be given in this contribution.

References

- [1] V. Koscheev et al., Use the results of measurements on KBR facility for testing of neutron data of main structural materials for fast reactors. EPJ Web Conf. 146, 06025 (2017).
- [2] N. Dauphas et al., Neutron-rich chromium isotope anomalies in supernova nanoparticles. Astrophys. J. 720, 1577 (2010).

Primary author: SHAO, Zefeng (東京科学大学/Institute of Science Tokyo)

Co-author: KATABUCHI/片渕, Tatsuya/竜也 (東京科学大学/Institute of Science Tokyo)

Presenter: SHAO, Zefeng (東京科学大学/Institute of Science Tokyo)

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