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Development of accurate measurement method for neutron capture cross-sections by neutron activation analysis/中性子放射化分析による中性子捕獲断面積の高精度測定手法の開発

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Neutron activation analysis is a highly sensitive and convenient method for qualitative analysis, but it was thought to be unsuitable for quantitative analysis. However, we have applied this method to quantitative analysis and have succeeded in measuring neutron capture cross-sections with high accuracy. By paying careful attention to uncertainty factors related to measurements, such as sample preparation in the experimental process, the neutron irradiation field, the use of Gd shielding material instead of a conventional Cd material, the development of neutron flux monitors, and the nuclear data used for analysis, we have developed a highly accurate measurement method for neutron capture cross-sections. Using this technique, we have been able to carry out systematic measurements of long-live fission products [1-3], minor actinides [4-8] and isotopes [9-13], and have succeeded in deriving cross-section data. When it was difficult to obtain a single element sample, impurities in a sample were used, and their abundance ratio was examined by mass spectrometry to quantify the amount of the target sample, resulting in successful irradiation experiments [14]. Furthermore, when a daughter nuclide is a stable one, it is impossible to derive the cross-section by conventional activation method. However, by combining activation analysis with mass spectrometry. However, by combining activation analysis and mass spectrometry, we succeeded in deriving the cross-sections, demonstrating that mass spectrometry is a very powerful method for measuring cross-sections [15]. This presentation will provide some examples of the experiments and outline how the cross-section data were derived.

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