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Evaluation of 232Th and 237Np fast neutron-induced fission cross sections by simultaneous evaluation approach

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The Hauser-Feshbach formalism and Hill-Wheeler formula provide a reliable framework for describing fission cross-sections, particularly for fast neutrons, integrated into various nuclear reaction model codes such as TALYS, EMPIRE, CCONE and CoH. However, predicting fission cross-sections using this method relies on parameters like barrier heights, necessitating adjustments to closely match experimental data. The EXFOR library has a large number of experimental datasets, and it enables us to perform evaluation by least-squares analysis of the EXFOR datasets without a physics model. The least-squares analysis code SOK developed for simultaneous evaluation for the JENDL project has been successfully applied to evaluation of the ^{233,235,238}U and ^{239,240,241}Pu fission cross sections for fast neutrons.

As nuclear data libraries evolve, Nuclear Reaction Data Centres (NRDCs) increasingly prioritize compiling experimental uncertainty and covariance information. To facilitate this, the EXFOR format has expanded to include correlation property flags and adopt computer-readable matrix formats, enhancing data accessibility and usability. Moreover, there is growing interest in acquiring new experimental datasets relevant to simultaneous evaluations, notably from time-of-flight facilities such as CERN n_TOF and LANSCE.

In response to these advancements, we embarked on recreating the simultaneous evaluation of the neutron-induced fission cross section of ^{232}Th and ^{237}Np in the fast neutron region. These nuclides were chosen since (1) ^{232}Th energy dependent cross section and fission neutron spectrum averaged cross section show inconsistency, and (2) ^{237}Np is sometimes used as a reference and better to be a part of our simultaneous evaluation framework. The experimental ^{232}Th and ^{237}Np fission cross sections and their ratios to fission cross sections of other nuclides such as ^{235,238}U in the EXFOR library were reviewed and analyzed. Experimental covariances were estimated for each experimental dataset and incorporated in the new evaluation. The newly evaluated cross sections were validated against spectrum-averaged cross sections measured in the ^{252}Cf spontaneous fission neutron standard field.

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