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Current status and issues of evaluation of thermal neutron scattering law for nuclear reactor moderators/原子炉用減速材の熱中性子散乱則評価の現状と課題

Thursday, 14 November 2024 15:20 (30 minutes)

This talk will introduce and discuss the current status and issues of the evaluation of thermal scattering laws (TSL) in the development of the Japanese Evaluated Nuclear Data Library, JENDL.

In thermal neutron reactors, the TSL of the moderator has a significant impact on core calculations. In the JENDL series, the latest version, JENDL-5, is the first to include an original evaluation of TSL. In this evaluation, the TSL of water, a typical moderator, and hydrogen-containing organic compounds such as methane, which is used as a moderator in neutron sources, were evaluated based on molecular dynamics calculations.

However, data for crystalline materials was obtained from the ENDF/B-VIII.0 library. Crystalline materials are often used as moderators in thermal neutron reactors. Such examples are graphite in high-temperature gas-cooled reactors and molten salt reactors, and calcium hydride (CaH2) in small reactors.

Under these circumstances, we have started to establish a method for evaluating the TSL of crystalline materials with the aim of enhancing the TSL data in JENDL. As a result, we have obtained results that reproduce the experimental values of neutron scattering at J-PARC well for graphite and CaH2 by using an evaluation method based on first-principles calculations.

In addition, further improvements are underway for the TSL of light water. In order to improve reliability under high-temperature and high-pressure conditions such as reactor operation conditions, we are developing a method for evaluating TSL using molecular dynamics calculations with potentials based on first-principles calculations, which are considered to have high predictability for changes in temperature and pressure. We will also discuss the progress of evaluating TSL for light water using this method.

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