NUCLEAR ENERGY UNIVERSITY PROGRAMS

Accurate Development of Thermal Neutron Scattering Cross Section Libraries

PI: Hawari, Ayman - North Carolina State University

Collaborators:
Dunn, Michael - Oak Ridge National Laboratory

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Abstract

The objective of this project is to develop a fundamental, accurate, holistic approach for generating thermal neutron scattering cross-section libraries for a collection of important neutron moderators and reflectors. The primary components of this approach are the physical accuracy and completeness of the generated data libraries. The research team will generate thermal neutron scattering cross-section data libraries based on accurate theoretical models that are carefully benchmarked against experimental and computational data, and that contain complete covariance information that can be used in propagating the data uncertainties through the various components of the nuclear design and execution process. To achieve the above objective, the project will perform computational and experimental investigations on a carefully selected subset of materials that play a key role in all stages of the nuclear fuel cycle. The chosen materials are beryllium (Be), reactor-grade graphite, light water (H_2O), and silicon dioxide (SiO_2). All these materials are important neutron moderators and reflectors. Graphite and H_2O are the main moderators in key reactor concepts such as very high-temperature reactors and light water reactors. SiO_2 is the principal constituent of sand, which is found in nuclear materials repositories and is a main constituent of concrete, a common structural and shielding material at nuclear installations.