**Advanced hydride moderator irradiations for microreactor and space nuclear reactor deployment**

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**Program**: NSUF-2

**ABSTRACT:**

The proposed project aims to study the impact of the neutron displacement damage to the yttrium hydrides. The neutron displacement damage can displace hydrogen from its interstitial positions in the hydride lattice, and the formation of extended defect structures such as dislocation loops may cause hydrogen's accelerated escape from the hydride. To investigate the neutron displacement damage, near stoichiometry yttrium hydrides will be subject to neutron irradiation at low temperatures (T=300, 400, and 500°C) where thermal and concentration dependent diffusional processes of hydrogen are restricted in the yttrium hydride lattice. Neutron-irradiations will be performed at the flux trap regions of High Flux Isotope Reactor (HFIR) facility at Oak Ridge National Laboratory (ORNL). Specimens will be subject to neutron damage levels of 1 and 2 displacement-per-atom (dpa). After testing in HFIR, irradiation capsules will be sent to the Irradiated Materials Examination and Testing Facility at ORNL for capsule disassembly, specimen retrieval, and preparation. Prepared specimens will be shipped to the Low Activation Materials and Analysis (LAMDA) laboratory at ORNL. Specimen microstructure will be characterized using scanning and analytical transmission electron microscopy, as well as electron back scatter diffraction. Thermophysical properties and specimen hydrogen loss will also be measured to determine the impact of neutron irradiation on these properties. The experimental property data developed in this project will provide key insights into the fundamental irradiation-induced degradation of yttrium hydride under prototypic micro and space reactor moderator conditions of dose and temperature.