

Development of Advanced High Uranium Density Fuels for Light Water Reactors

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ABSTRACT

The goal of the proposed work is to develop advanced high uranium density fuels for use in LWRs. Development of high-density nuclear fuel is of prime importance to LWRs. This technology will allow for large power uprates and/or increased cycle lengths that contribute to the economic sustainability of existing and future nuclear plants. Two materials are proposed for investigation; the single phase compound U_3Si_2 and a two-phase composite of UN-UO2. The U_3Si_2 and UN-UO2 composites will be evaluated for irradiation stability, high temperature water corrosion resistance, thermal conductivity, and mechanical properties, such as hardness and fracture toughness. The effect of ion irradiation on microstructure evolution, thermal and mechanical property changes will be studied. In addition to this proposed work, in-pile irradiation tests of U_3Si_2 fuel under light water reactor irradiation conditions have been awarded to Boise State University through the Advanced Test Reactor-National Scientific User Facility (ATR-NSUF) and will be performed in the ATR. These neutron irradiated U_3Si_2 samples are an important adjunct to the current proposal. The combined ion and neutron irradiation results generated by this body of work will improve the current understanding of irradiation stability and water corrosion resistance of high uranium density compounds, and will make a significant positive impact on the development of advanced nuclear fuels.