THE ORNL HIGH FLUX ISOTOPE REACTOR AND NEW ADVANCED FUEL TESTING CAPABILITIES

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ABSTRACT

The U.S. Department of Energy's High Flux Isotope Reactor (HFIR), located at the Oak Ridge National Laboratory (ORNL), is a beryllium-reflected, pressurized, light-water-cooled and moderated flux-trap-type reactor. The core consists of aluminum-clad involute-fuel plates, which currently utilizes highly enriched ^{235}U fuel, with a design power level of 85 MW. The HFIR was originally designed (in the 1960s) primarily as a part of the overall program to produce transuranic isotopes for use in the heavy-element research program of the United States. Today, the reactor is a highly versatile machine, producing medical and transuranic isotopes, and performing materials test experimental irradiations and neutron-scattering experiments, including the capability to conduct cold-source low-temperature neutron experiments.

The ability to test advanced fuels and cladding materials in a thermal neutron spectrum in the United States is limited, and a fast-spectrum irradiation facility does not currently exist in the U.S. The HFIR has a distinct advantage for consideration as a fuel/cladding irradiation facility because of the extremely high neutron fluxes that this reactor provides over the full thermal to fast neutron energy range. New test capabilities have been developed that will allow testing of advanced nuclear fuels and cladding materials in the HFIR under prototypic light-water reactor (LWR) operating conditions. Two experiments utilizing this LWR facility were initiated in the Summer of 2010. In addition, experiments which focus on the microstructural evolution of fast reactor fuels in the early phase of irradiation at prototypic fast reactor conditions are being designed and should be initiated in mid-2011.

This paper will describe the HFIR testing capabilities, the new advanced fuel/cladding testing facilities, and the initial irradiation experiments and results (to date).