

# International Nuclear Energy Research Initiative

## U.S. DEPARTMENT OF ENERGY INTERNATIONAL NUCLEAR ENERGY RESEARCH INITIATIVE DOE/France

### ABSTRACT

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#### Development of Fuels for the Gas-cooled Fast Reactor

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**Principal Investigator (France):** N. Chauvin, Commissariat à l'Énergie Atomique (CEA)-Cadarache

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**Project End Date:** October 2007

**Collaborators:** Joint Research Center Institute for Transuranium Elements, Idaho National Engineering and Environmental Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory

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GFR (Gas-cooled Fast Reactor) fuel operating parameters and physical requirements are outside of the envelope of the current experimental nuclear fuel database. Many basic viability issues will need to be experimentally addressed to demonstrate the feasibility of proposed GFR fuels.

Two basic fuel types appear to be viable for GFR service; refractory matrix dispersions and refractory metal or ceramic clad pin-type fuels. This project seeks to develop fuels of these types suitable for GFR service and demonstrate feasibility of these fuels through analysis of fuel requirements, simulation of fuel behavior using fuel performance models, fabrication of fuel specimens, characterization of microstructure and properties, and scoping fuel irradiation testing. Ion irradiation testing of materials will be conducted to simulate material behavior at high irradiation doses in short times. The GFR-F1 test in ATR (and also the FUTURIX-MI test in Phénix) also addresses basic issues regarding the irradiation behavior of the 'exotic' refractory materials required for GFR fuel service in a neutron only environment. Ultimately, proof-of-concept for GFR fuel can only be demonstrated through irradiation testing of fissile-bearing specimens. The GFR-F2 scoping fuel irradiation test in the ATR is planned as an integral fuel behavior tests that will give the first true indication of fuel feasibility.

This work is currently performed under Gen IV work package A0404J012 and AFCI work package A0202J61 supported by the DOE, and under actions Partitioning and Transmutation (3112) and Safety of Nuclear Fuels (3135) of the JRC-ITU EURATOM direct program. The proposed work will be conducted within the GFR Fuel Project (i.e. with participation from GIF partners France, UK, Japan, and South Korea). Data collected as a result of this work will be leveraged to the extent possible to provide data relevant to small modular reactor and LWR inert matrix fuel development efforts.

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