

NUCLEAR ENERGY RESEARCH INITIATIVE

A Research Program on Very High-Temperature Reactors (VHTRs)

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Collaborators:
North Carolina State University
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Project Number: 08-043

Program Area: Generation IV

Project Description

Prismatic and pebble bed very high-temperature reactors (VHTRs) are very attractive both from a thermodynamic efficiency viewpoint and hydrogen-production capability. This project addresses numerous challenges associated with the fuel cycle, materials, and complex fluid dynamics and heat transfer. Consortium members will:

- Conduct physical experiments for fission product transport phenomena in the overcoating and compact structural graphite and transport through TRISO coating layers
- Develop improved sorption measurement techniques to measure the accumulation of condensable radionuclides (“plateout”) in the VHTR primary coolant circuit and obtain representative data
- Develop advanced computations of charged, radioactive dust (aerosol) transport in the VHTR coolant circuit and confinement by exploring direct simulation Monte Carlo (DSMC) techniques for deposition and resuspension and conduct experiments to verify computational predictions
- Develop a program to measure emissivity for various VHTR component materials, both bare and oxidized, and obtain extensive data
- Develop an experimental program to characterize gas, fission product, and particle flows in the complex geometries of pebble bed modular reactors (PBMRs) and help improve computational approaches and computer programs through experimental understandings

This project will also lead to graduate student research training at the participating universities and possible practicums on VHTR technology at the national laboratories. Upon graduation, these students will be able to contribute even more effectively to the future challenges in the global deployment of nuclear power generation and hydrogen technologies.