



The Nuclear Heat Source Technology Development and Qualification Needs



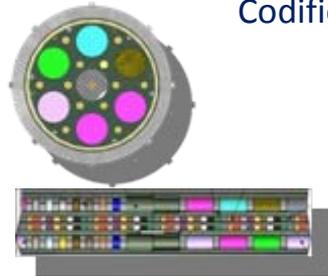
High Temperature Materials Characterization, Testing and Codification



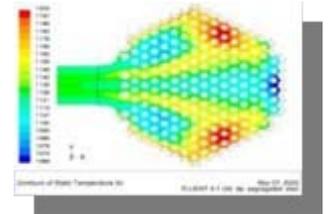
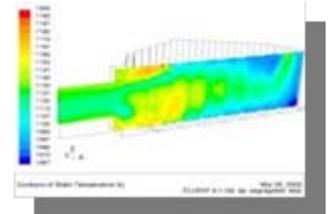
Fuel Fabrication, Irradiation, and Safety Testing



Graphite Characterization, Irradiation Testing, Modeling and Codification



Design and Safety Methods Development and Validation



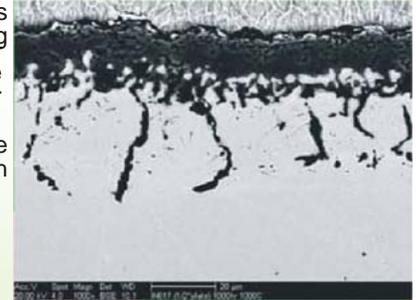


High Temperature Materials Qualification

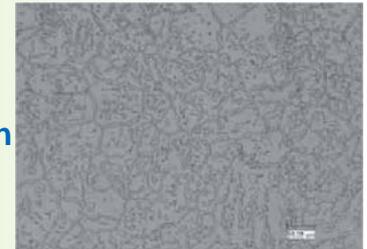
Development of Material Properties and Design Rules and ASME Codification

- Materials:**
- Pressure vessel steels
 - Alloys for heat exchangers (up to 800°C)
 - Control rod sleeves and other core internals

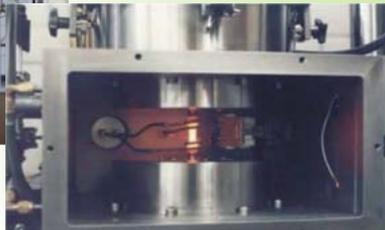
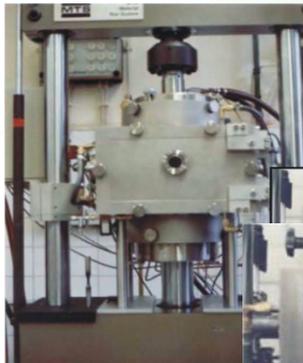
Ni from Watts bath plating
 Cr Oxide surface layer
 Al Oxide intergrowth



Material Characterization



Mechanical Testing



Environmental Testing

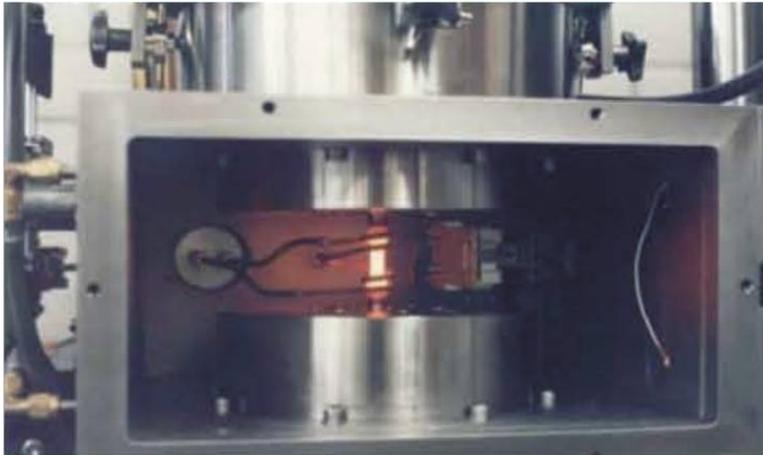


Program Participants
INL, ORNL, ANL



VHTR Materials Project

Mission: Coordinate R&D on materials technologies needed to establish the viability and performance of VHTR (and Gas Fast Reactor) reactor systems, and maintain resulting documentation of results



Mechanical Properties Testing

Members:

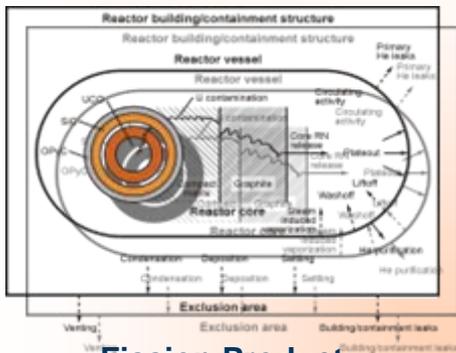
- US, Japan, Korea, Canada, France, Switzerland, South Africa and the European Union (China expected to join in 2011)
- Project Arrangement effective April 30, 2010
- PMB Chair – Bill Corwin (ORNL)

U.S. Contributions:

- Graphite testing and code development
- High temperature materials (including ceramics) testing and code development
- Development and operations of Gen IV Materials Handbook (database)

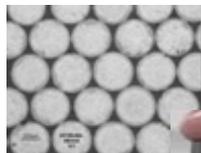
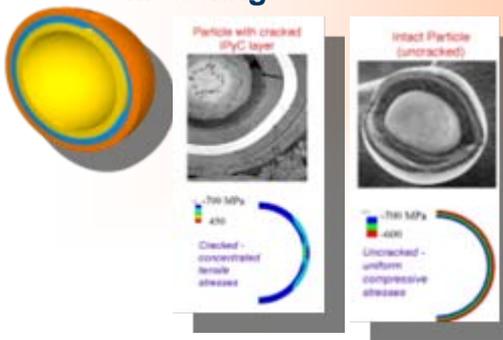


Fuel Qualification Program

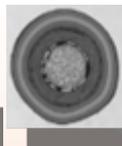


Fission Product Transport and Source Term

Fuel Performance Modeling



Fuel Supply



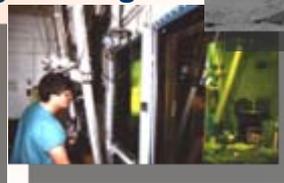
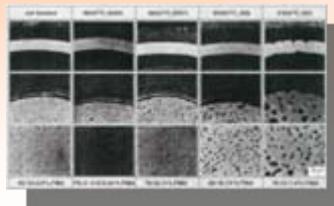
- Coated Particle Fuel Fabrication
- Fuel Qualification
- Analysis Methods Development and Validation



Fuel and Materials Irradiation



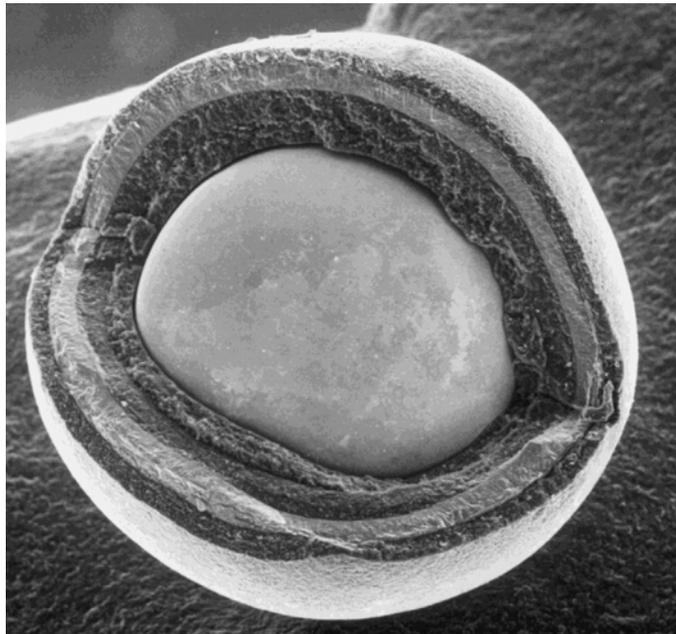
Post Irradiation Examination and Safety Testing





VHTR Fuels and Fuel Cycle Project

Mission: Provide demonstrated solutions for the VHTR fuel (design, fabrication and qualification of TRISO particle fuel) and for its back-end management



1000 micron Coated Particle Fuel

Members:

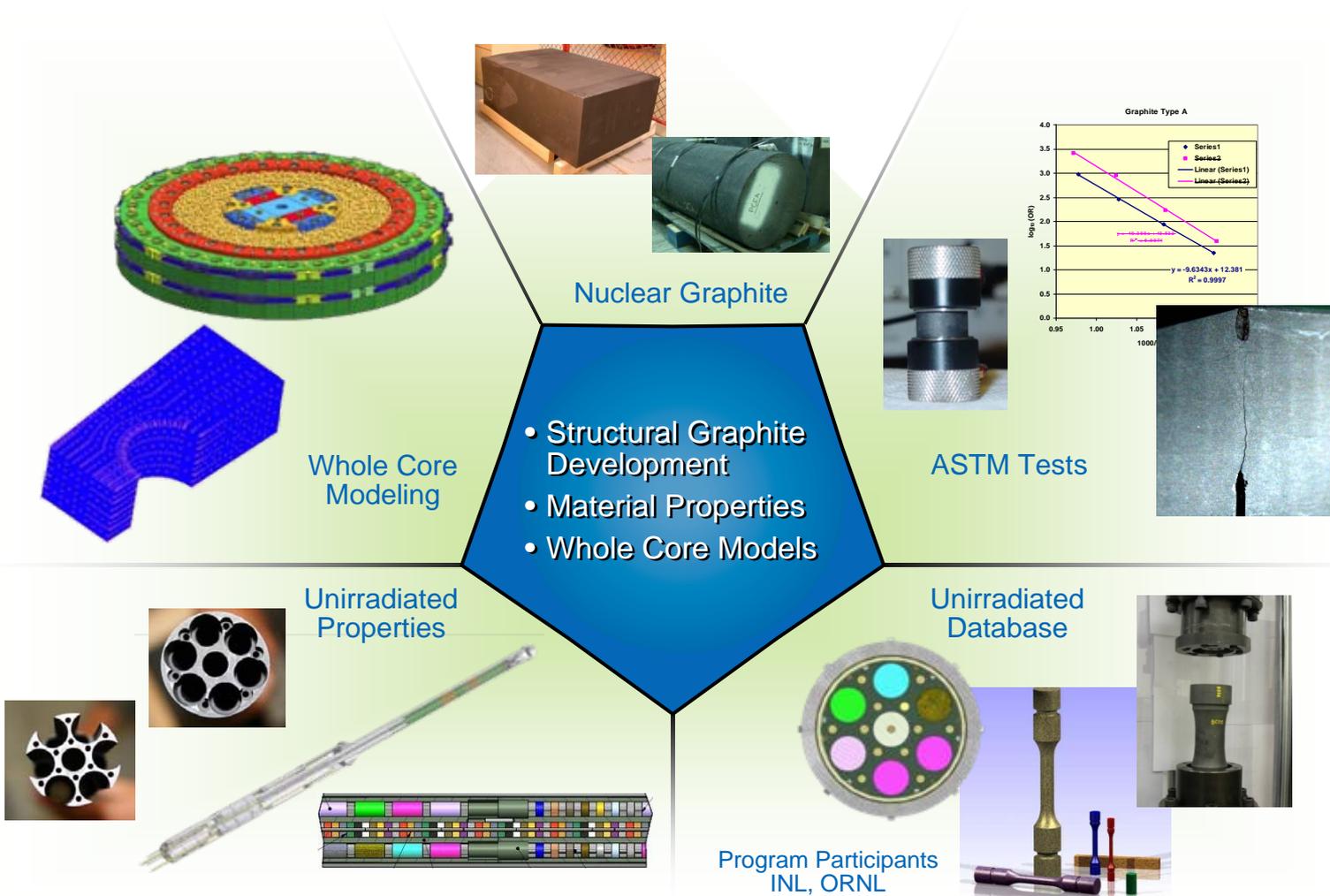
- US, Japan, Korea and the European Union
- Project Arrangement effective January 30, 2008
- PMB Rep – Dave Petti (INL)

U.S. Contributions:

- AGR-2 Experiment – Testing of U.S, RSA, and French fuels including irradiation in Advanced Test Reactor
- Analysis of plutonium burning and transmutation through the Deep Burn project

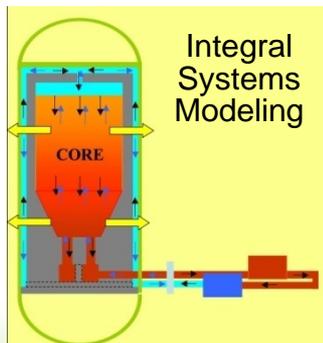


Graphite Materials Qualification

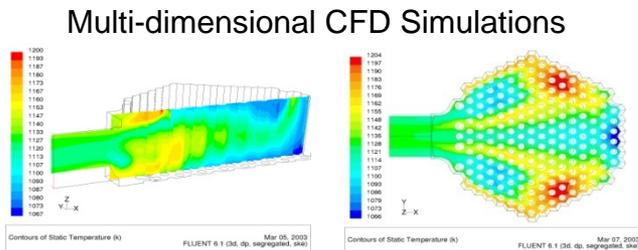




Design & Safety Methods & Validation

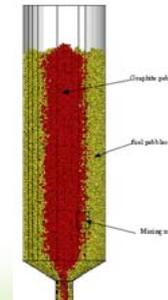
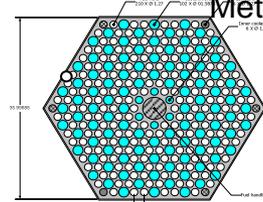


Integral Systems Modeling



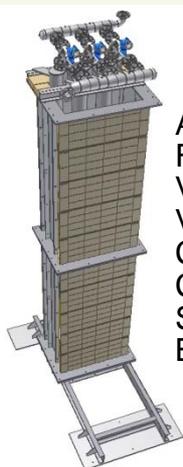
Physics, Thermal and System Safety Methods, Code Development and Application

Pebble and Prismatic Physics Methods



Design Methods and Validation

Separate Effects & Integral Testing Under Normal & Off-Normal Conditions



ANL Facility to Validate VHTR Cavity Cooling System Behavior



INL's Matched Index of Refraction (MIR) Facility to Study 3-D Flow Effects in Plena

Cross-section Measurements at LANL



Graphite/Air Reaction Rate Testing

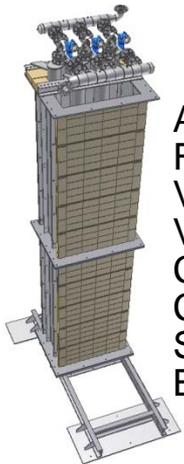
Scaled Vessel Testing





VHTR Computational Methods, Validation and Benchmarking Project

Mission: Ensure that numerical models used for reactor system analysis are capable of calculating the reactor system behavior at normal operational conditions and for operational transients and accident scenarios



ANL
Facility to
Validate
VHTR
Cavity
Cooling
System
Behavior



INL's Matched Index of
Refraction (MIR) Facility
to Study 3-D Flow
Effects in Plena

Provisional Members:

- US, Japan, Korea, Canada, China, South Africa and the European Union
- Project Arrangement expected in 2011
- PMB Co-Chair – Dick Schultz (INL)

U.S. Planned Contributions:

- Computational fluid dynamics (CFD) problem designs and validation data associated with MIR, HTTF, air ingress, and RCCS experiments
- Models and experimental data to determine effects of neutron damage on graphite
- Compilation of available benchmarks and measurements of HTR/VHTR neutronic parameters, and assessment of relevance for current activities