



Office of Nuclear Energy FY 2010 University Program Workshop

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VHTR

Gen IV Materials

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Overall Work Scope

◆ Graphite R&D program

- Non-irradiated and irradiated material property studies
 - Thermal, mechanical, and physical testing
 - Statistical non-irradiation baseline database of material properties
 - Irradiated material studies (Post-irradiation examination)
- Modeling
 - Micromechanical and whole core
- ASME
 - Codification and NRC licensing issues
- ASTM research and development
 - Improvements on existing tests
 - **New research needed for addition tests**
 - **Long-term research areas**



What research in graphite/composites is needed

◆ Development of low irradiation, continuous fiber reinforced composite components (ceramic and carbon-based)

- This research applies to the development of continuous fiber reinforced carbon and/or ceramic composite structures for use outside the graphite core of a VHTR design.
- Based upon the needs identified within the 2008 AREVA Composites Report (TDR-3000807-001) and the 2008 GA Composites Report (911125) which are publicly available on the NGNP external website.

◆ Development of high irradiation, continuous fiber reinforced composites (specifically control rods)

- Fabrication and performance measurements of CFCs (SiC only).



What research in graphite/composites is needed

◆ Non-destructive examination techniques for graphite and composites

- Development of techniques viable for detecting disparate flaws such as voids, large inclusions, and (large) cracks in large graphite components or as-fabricated billets/blocks
- Development of techniques to detecting fiber damage, or fiber/matrix damage within composites
- Determination of in-situ techniques for degradation of thermal properties (i.e. conductivity/resistivity) in graphite
- Development of in-situ techniques for detecting residual stress build-up within graphite components
- Development of in-situ techniques for detection of component cracking within graphite and composite components



Needs and timeline

◆ Development of Fundamental mechanisms for graphite

- Development of fundamental understanding in graphite strength mechanisms
- Investigations of irradiation damage and effects of irradiation on material properties within graphite and composites

◆ Timelines

- Some fundamental understanding/clarification of creep mechanisms for model development needed in 5-6 years
- Non-destructive examination will be needed in medium and long term for component inspections before insertion and for in-situ inspections after startup
- Composite components needed for ASME/NRC in 8-9 yrs