

Ag Transport Through Non-Irradiated And Irradiated SiC

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ABSTRACT

An integrated experimental and modeling study will be carried out to discover the effects of radiation on fission product transport in SiC. SiC is currently used for coatings of fuel particles in Very High Temperature Reactor (VHTR) applications. One of the major problems with SiC in this application is undesired transport of Ag from fuel core into the coolant. Understanding microstructure- and environment-dependent mechanisms that control Ag diffusion through SiC is needed in order to design a coating with superior retention capabilities. Specific objectives of this project are: (i) to determine whether observed variation in integral release measurements of Ag through SiC can be explained by differences in grain size and grain boundaries (GB) types among the samples; (2) to identify the effects of irradiation on diffusion of Ag through SiC; and (3) to discover phenomena responsible for significant solubility of Ag in polycrystalline SiC. Diffusion couple experiments and proton irradiation will be combined with state-of-the-art characterization (SIMS, S/TEM-EDS) to identify trends in Ag concentration profiles as a function of radiation dose and temperature. Modeling will bring together *ab initio* studies of Ag solubility and diffusion coefficients, rate theory models of radiation damage, and kinetic Monte Carlo studies of diffusion through experimentally determined microstructures. Both experiments and modeling will determine diffusion coefficients and Ag concentration profiles so that jointly these two approaches can lead to a discovery of the fundamental mechanisms that control Ag release.