

Public Abstract

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Title:Measurement of Fission Product Diffusion in VHTR Materials

Measuring and quantifying the diffusion of fission products in reactor materials is a critical element of the future success of Very High Temperature Reactors (VHTRs). While the extreme temperatures, which may be in excess of 1000 degrees C, allow for very high efficiencies, potentially in the range of 45-50%, they also can be problematic due to the increase in fission product transport. The aim of this work was to explore a repeatable, accurate, and cost effective process to measure the diffusion coefficients of fission products in VHTR materials, particularly those materials used in the fabrication of TRISO fuel particles. This work focuses on the diffusion of silver in graphite.

We constructed graphite cells which could be filled with a silver diffusant. This diffusant may take the form of silver flakes, silver powder, or a silver-laden graphite powder. The cells were hermetically sealed and heated to temperatures comparable to those found in VHTRs. These cells were imaged using microtomography and electron microscopy. Diffusion profiles were determined by sectioning the heat-treated cells and analyzing them using Neutron Activation Analysis (NAA), which was performed at the University of Missouri Research Reactor (MURR). Estimated diffusion coefficients for silver in commercial-grade graphite are reported.