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Topological investigation of nuclear graphite using small angle scattering[1] DURGESH K. RAI, BORIS KHAYKOVICH, Massachusetts Institute of Technology, ANNE A. CAMPBELL, Oak Ridge National Laboratory, JAN ILVASKY, Argonne National Laboratory, YUTAI KATOH, Oak Ridge National Laboratory, LANCE L. SNEAD, Massachusetts Institute of Technology — Nuclear power reactors require high performance materials that withstand high temperatures and neutron damage over long period of times. Graphite is widely used for high temperature fission reactor applications. It has a complex multiphase microstructure, which is affected by neutron irradiation. The irradiation-induced microstructures result in significant thermophysical property changes, affecting service lifetimes. It is important to understand these life-limiting phenomena at many different length scales. We present the results from small angle scattering (SAS) studies on graphite samples, which vary in doses and irradiation temperatures. The neutron and synchrotron SAS measurement data indicates that the graphite morphology consists of surface fractal structures. The samples were found to be uniform across several decades of length scale, while exhibiting different surface fractal dimensions, for different irradiation doses and temperature conditions. The surface fractal dimension changes at <10nm length scale for the sample irradiated at a temperature of ˜622 C, but not for the sample irradiated at ˜345 C.

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