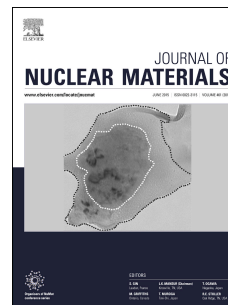


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Ion irradiation induced nucleation and growth of nanoparticles in amorphous silicon carbide at elevated temperatures

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Abstract

Ion irradiation induced crystallization in as-deposited amorphous SiC films is investigated using grazing-angle incidence x-ray diffraction (GIXRD), transmission electron microscopy (TEM) and Raman spectroscopy. Irradiation with 5 MeV Xe to fluence of 1.15×10^{16} Xe/cm² at 700 K results in a homogenous distribution of 3C-SiC grains with an average crystallite size of ~5.7 nm over the entire film thickness (~1 μ m). The nucleation and growth processes exhibit a weak dependence on dose in displacements per atom (dpa) in the range from ~6 dpa at the film surface to ~20 dpa at the SiC/Si interface. A transformation of homonuclear C-C bonds from sp³ to sp² hybridization is observed in the irradiated films, which may be partly responsible for the observed grain size saturation. The results from this study may have a significant impact on applications of SiC as structural components of advanced nuclear energy systems.

Keywords: Silicon Carbide; Crystallization; Ion irradiation

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