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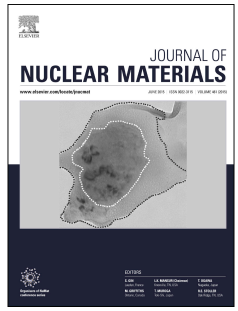

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Distribution of defect clusters in the primary damage of ion irradiated 3C-SiC

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Abstract

We report a statistical analysis of sizes and compositions of clusters produced in cascades during irradiation of SiC. The results are obtained using molecular dynamics (MD) simulations of cascades caused by primary knock-on atoms (PKAs) with energies between 10 eV and 50 keV. The results are averaged over six crystallographic directions of the PKA and integrated over PKA energy spectrum derived from the Stopping and Range of Ions in Matter (SRIM) code. Specific results are presented for 1 MeV Kr ion as an example of an impinging particle. We find that distributions of cluster size n for both vacancies and interstitials obey a power law $f = A/n^S$ and these clusters are dominated by carbons defects. The fitted values of A and S are different than values reported for metals, which can be explained through different defect energetics and cascade morphology between the two classes of materials. In SiC, the average carbon ratio for interstitial clusters is 91.5%, which is higher than the ratio of C in vacancy clusters, which is 85.3%. Size and composition distribution of in-cascade clusters provide a critical input for long-term defect evolution models.

Keywords

silicon carbide, intra-cascade clusters, size distribution, cluster composition