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Atomistic structures of nano-engineered SiC and radiation-induced amorphization resistance

Kenta Imada,[1] Manabu Ishimaru,[1,*] Kazuhisa Sato,[2] Haizhou Xue,[3] Yanwen Zhang,[4,3] Steven Shannon,[5] and William J. Weber[3,4]

[1]*Department of Materials Science and Engineering, Kyushu Institute of Technology, Kitakyushu, Fukuoka 804-8550, Japan*

[2]*Institute for Materials Research, Tohoku University, Sendai, Miyagi 980-8577, Japan*

[3]*Materials Science and Engineering Department, University of Tennessee, Knoxville, TN 37996-2200, USA*

[4]*Materials Science and Technology Division, Oak Ridge National Laboratory, Tennessee 37831-6138, USA*

[5]*Department of Nuclear Engineering, North Carolina State University, Raleigh, North Carolina 27695, USA*

Abstract

Nano-engineered 3C-SiC thin films, which possess columnar structures with high-density stacking faults and twins, were irradiated with 2 MeV Si ions at cryogenic and room temperatures. From cross-sectional transmission electron microscopy observations in combination with Monte Carlo simulations based on the Stopping and Range of Ions in Matter code, it was found that their amorphization resistance is six times greater than bulk crystalline SiC at room temperature. High-angle bright-field images taken by spherical aberration corrected scanning transmission electron microscopy revealed that the distortion of atomic configurations is localized near the stacking faults. The resultant strain field probably contributes to the enhancement of radiation tolerance of this material.

Keywords: nanostructured materials; carbides; amorphization; scanning/transmission electron microscopy (STEM)

*To whom correspondence should be addressed. E-mail: ishimaru@post.matsc.kyutech.ac.jp