Effect of Low-Energy Proton Radiation on the Degradation of Silicon Carbide Schottky Diodes

Journal of Electronic Materials • Article • 2025 • DOI: 10.1007/s11664-025-11939-y

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Abstract

Silicon carbide (SiC) Schottky diodes are gaining traction for their potential in high-voltage, high-temperature, and radiation-resistant applications. While superior to traditional silicon (Si) diodes, their radiation hardness requires further exploration, particularly at lower energies. Although high-energy radiation undoubtedly degrades devices, understanding the impact of lower-energy radiation is crucial for real-world applications. This study employed 8 MeV proton radiation, considered relatively low energy in radiation physics, to investigate the response of SiC Schottky diodes. Interestingly, the irradiated devices displayed a slight decrease in reverse leakage current, indicating improved blocking ability. Encouragingly, both forward current and capacitance remained relatively unaffected, with a minor change in the ideality factor. Microscopy confirmed these findings by

revealing no surface-level defects or leakage current hotspots, solidifying the exceptional resilience of SiC Schottky diodes to even lower-energy radiation. © The Minerals, Metals & Materials Society 2025.

Author keywords

defects; degradation; ideality factor; proton; radiation; Schottky diodes (SDs); Silicon carbide (SiC)

Indexed keywords

Engineering controlled terms

Heat radiation; Leakage currents; Radiation damage; Schottky barrier diodes

Engineering uncontrolled terms

High-voltages; Ideality factors; Low-energy protons; Lower energies; Lower energy radiation; Proton radiations; Schottky diode; Schottky diodes; Silicon carbide; Silicon carbide schottky diodes

Engineering main heading

Silicon carbide

Funding details

Details about financial support for research, including funding sources and grant numbers as provided in academic publications.

Funding sponsor	Funding number	Acronym
International Islamic University Malaysia See opportunities by IIUM	KOEIEMS24	IIUM
International Islamic University Malaysia See opportunities by IIUM		IIUM

Funding text

The authors acknowledge the International Islamic University, Malaysia, for supporting the IIUM Engineering Merit Scholarship 2024 (KOEIEMS24) for Outstanding Students at Kulliyyah of Engineering, IIUM, Gombak, Malaysia. The authors acknowledge the support of MIMOS Berhad, Malaysia, in their support for carrying out the structural characterization of the devices.

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Abstract

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