

CALCULATIONS AND MEASUREMENTS OF THE EFFECT OF NEUTRON IRRADIATION ON SiC SEMICONDUCTOR DETECTORS, SENSORS AND DEVICES

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The Ohio State University, Columbus, Ohio

Nuclear Science and Technology Division Seminar

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Abstract

Over the past few years a number of Ohio State University students (B. Khorsandi, M. Reisi-Fard, V. Krishnan, S. Stone, P. Zhang, and J. Kulisek) and faculty (T. E. Blue, D.W. Miller, and W. Windl) have studied the effects of neutron and gamma-ray irradiation on the performance of SiC semiconductor diode neutron detectors, piezoresistive pressure sensors and power diodes. Experimental studies have been accompanied by simulations of performance, including predictions of the effects of annealing. This presentation reviews the evolution of our research effort. Throughout the presentation, the effects of neutron-induced displacement damage are apparent in the degradation of the performance of the detectors, sensors and devices, as are the effects of the partial restoration of the performance of the devices as a consequence of annealing. The effects of annealing are experimentally examined for relatively low temperatures (175C), and are modeled for higher temperatures (500K), since the usefulness of SiC detectors, sensors and devices in radiation fields with high rates of displacement damage is crucially dependent on the annealing of the induced damage.

^[1] Dr. Blue is a professor of Nuclear and Mechanical Engineering at the Ohio State University, where he has been a faculty member since 1985. He serves as Director of the OSU Nuclear Reactor Laboratory. His research interests are space nuclear systems, advanced nuclear reactor instrumentation, including semiconductor sensors, static and dynamic characterization of radiation-induced degradation of semiconductor power devices, and accelerator-based Boron Neutron Capture Therapy (BNCT) for cancer. Dr. Blue is a Fellow of the American Nuclear Society. He graduated with a Ph.D. in Nuclear Engineering from the University of Michigan, a fact that he is reminded of by his colleagues every November.