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Modeling in Power Electronics - Comparison of the Forward Voltage Drop of Si and SiC High Voltage Diodes

By

Dr. Tanya K. Gachovska, Solantro Semiconductor Corp., Ottawa

DATE: Thursday, January 29, 2015.
TIME: Refreshments, Registration and Networking: 18:00; Seminar: 18:30 – 20:00.
PLACE: Algonquin College, T-Building, Room T129, 1385 Woodroffe Ave., Ottawa.
PARKING: No fee after 5 p.m. at the Parking Lots 8 & 9. Please respect restricted areas.

Abstract - Obtaining high efficiency of a power converter requires use of well chosen components to build it. Power semiconductor switches are responsible for significant power losses. For the same breakdown voltage, silicon carbide (SiC) bipolar devices have significantly thinner, lightly doped drift region (n-base) compared to silicon (Si) devices. Consequently, SiC bipolar devices have lower voltage drops in the drift region and lower switching losses. The reduction of power loses is important for power electronics applications in Smart Grids, higher voltages and higher switching efficiencies in switchgear and custom power systems/devices (in Distribution Systems for Medium Voltage levels and in Distributed Energy Resources such as solar, wind, and energy storage systems), EPRI Solid-State Intelligent Universal Transformer, etc.

The forward voltage drops of bipolar devices are the sum of the drift region voltage drop and the junction voltages. The junction voltages of Si devices are significantly smaller as compared to a SiC device since their band gap is smaller. Therefore, for lower voltage devices (< 6.5 kV), the forward voltage drops are smaller for Si as compared to SiC devices. For high voltage devices, the opposite is true. In this seminar, physics-based models of Si and SiC diodes will be presented and used to calculate the forward voltage drop for different breakdown voltages and the simulation results are compared to determine the appropriate choice of Si and SiC devices based on their breakdown voltage. The instrumentation and measurements for obtaining the experimental data for modeling will be discussed.

Speaker's Bio

Tanya Kirilova Gachovska received her B.Sc., M.Eng., and Ph.D. Degrees, all in Electrical Engineering, from the University of Ruse, Bulgaria, in 1994, 1995 and 2003, respectively. She earned her second Ph.D. Degree in Electrical Engineering (Power Electronics), at the University of Nebraska-Linkoln (UNL), Lincoln, USA in 2012. Her Ph.D. thesis was "Modeling of Power Semiconductor Devices". She worked as an Assistant Professor at the University of Ruse from 1999 to 2003. She conducted research from 2004 to 2006 and taught for a semester in 2006 at McGill University in Montreal. She worked as a Postdoctoral Research Scientist in the area of Pulsed Electric Fields at UNL from 2012 to 2013. During her Ph.D. Studies at UNL, she taught various courses and labs, and continued a collaboration in Pulsed Electric Fields research with McGill University, University of Ruse, University of Djiali Liabes, Sidi Bel Abbes, Algeria and École Nationale Supérieure Agronomique, El Harrach, Algeria. She joined Solantro Semiconductor, Corp., Canadian Office in Ottawa in 2013. Dr. Gachovska authored or co-authored more than 30 technical papers and conference presentations, two books, and holds a world patent in Pulsed Electric Fields.

Admission: Free. Registration required.

Please register by e-mail contacting: raedabdullah@ieee.org.