Tutorial #2

HV SiC Devices Enabled MV Power Converters Applications and Circuit Topologies – Opportunities and Challenges

Subhashish Bhattacharya – North Carolina State University

Biography

Subhashish Bhattacharya received his B.E. (Hons), M.E. and PhD degrees in Electrical Engineering from Indian Institute of Technology-Roorkee (formerly University of Roorkee), India in 1986, Indian Institute of Science (IISc), Bangalore, India in 1988, and University of Wisconsin-Madison in 2003, respectively. He worked in the FACTS (Flexible AC Transmission Systems) and Power Quality group at Westinghouse R&D Center in Pittsburgh which later became part of Siemens Power Transmission & Distribution, from 1998 to 2005. He joined the Department of Electrical and Computer Engineering at North Carolina State University (NCSU) in August 2005, where he is the ABB Term Professor, and also a founding faculty member and co-PI of NSF ERC FREEDM systems center (www.freedm.ncsu.edu), Advanced Transportation Energy Center [ATEC] (www.atec.ncsu.edu) and the newly established DOE initiative on WBG based Manufacturing Innovation Institute – PowerAmerica - at NCSU. He has authored over 300+ peer-reviewed technical articles, 2 book chapters, and has 4 issued patents to his credit. A part of his PhD research on active power filters was commercialized by York Corp. for their air-conditioner chiller application. His research interests are Solid-State Transformers, MV power converters, FACTS, Utility applications of power electronics and power quality issues; high-frequency magnetics, active filters, and application of new power semiconductor devices such as SiC for converter topologies

Abstract

The tutorial will stress in-depth the advantages of SiC over other power electronic materials, and will introduce SiC devices currently developed for power applications. The opportunities for HV SiC devices for MV Power Converters and utility applications and the challenges to apply these HV SiC devices successfully will be presented in-depth with SiC device voltage ranges from 1200 V to 1700 V MOSFETs, and HV 10 kV - 15 kV MOSFETs, JBS diodes, and 15 kV SiC IGBTs. The potential and challenges of the HV 10-15 kV devices to enable MV power conversion systems, including MV motor drives, FACTS and MVDC grids will be explored. Challenges in adopting these HV SiC devices for MV power conversion in terms of magnetics, capacitors, and insulation materials will be discussed. Prototype SiC-based power electronics systems will be shown and their numerous advantages will be articulated.