

WIDE BAND GAP DEVICES - Potentials versus Reality

Moderator:



Burak Ozpineci

Leader, Power Electronics and Electric Machinery Group
Manager, Advanced Power Electronics and Electric Motors
Oak Ridge National Laboratory

Burak Ozpineci received the B.S. degree in electrical engineering from the Orta Dogu Technical University, Ankara, Turkey, in 1994, and the M.S. and Ph.D. degrees in electrical engineering from the University of Tennessee, Knoxville, in 1998 and 2002, respectively.

He joined the Post-Masters Program with the Power Electronics and Electric Machinery Research Center, Oak Ridge National Laboratory (ORNL), Knoxville, TN, in 2001 and became a Full-Time Research and Development Staff Member in 2002 and the Group Leader of the Power and Energy Systems Group in 2008. He is currently the Group Leader for the Power Electronics and Electric Machinery Group and also has a Joint Faculty Associate Professor position with The University of Tennessee. His research interests include wide bandgap power devices, additive manufacturing for power electronics, multilevel inverters, power converters for distributed energy resources and hybrid electric vehicles, and intelligent control applications for power converters.

Dr. Ozpineci is the Vice Chair of the IEEE IAS Transportation Systems Committee and the Digital Media Editor for IEEE PELS. He was the recipient of the 2006 IEEE Industry Applications Society Outstanding Young Member Award, 2001 IEEE International Conference on Systems, Man, and Cybernetics Best Student Paper Award, and 2005 UT-Battelle (ORNL) Early Career Award for Engineering Accomplishment.

Panelists:



Alex Lidow

CEO and Co-founder
Efficient Power Conversion (EPC)

Alex Lidow is CEO and co-founder of Efficient Power Conversion Corporation (EPC). Since 1977 Dr. Lidow has been dedicated to making power conversion more efficient upon the belief that this

will reduce the harm to our environment from energy production and consumption. In order to pursue this mission, in 1977 he joined International Rectifier (NYSE:IRF) as an R&D engineer. In 1978 he co-invented the HEXFET power MOSFET, a power transistor that launched the modern power conversion market and displaced the aging bipolar transistor. The patents from this invention brought in more than \$900M over the years and International Rectifier to this day is the largest producer of power MOSFETs in the world.

Over the 30 years Dr. Lidow's was at IRF, his responsibilities grew. He progressed to the head of R&D, head of manufacturing, head of sales and marketing, and finally CEO for 12 years. Dr. Lidow holds many patents in power semiconductor technology, including basic patents in power MOSFETs as well as in GaN FETs. He has authored numerous publications on related subjects, and recently co-authored the first textbook on GaN transistors, "GaN Transistors for Efficient Power Conversion", now about to appear in its second edition published by John Wiley and Sons. In 2004 he was elected to the Engineering Hall of Fame, and in 2005 IRF, under Dr. Lidow's leadership, was named one of the best managed companies in America by Forbes magazine.

Dr. Lidow earned his Bachelor of Science degree in three years from Caltech in 1975 and his Ph.D. from Stanford in 1977 as a Fannie and John Hertz Foundation Fellow. Since 1998 Dr. Lidow has been a member of the Board of Trustees of the California Institute of Technology and has been the Chairman of the Compensation and Nominating Committees and Vice Chair of the Investment Committee.



Ljubisa Stevanovic
Chief Engineer, Energy Conversion
GE

Ljubisa Stevanovic has been with GE since 1993. His current role is Chief Engineer for Energy Conversion, directing GE's development of Silicon Carbide products, including power devices, advanced packaging and power electronic applications. Under his leadership, GE has commercialized SiC devices with performance, robustness and reliability ahead of competition, developed power packaging and thermal management solutions ideally suited for SiC devices, and fielded converters with best-in-class performance for aerospace applications. The 1.2kV SiC MOSFET is the industry first product to pass the most stringent AEC-Q101 qualification at 200°C.

Dr. Stevanovic's technical expertise covers power circuit topologies and controls, magnetics, SiC power devices, power packaging and thermal management. His application knowledge spans Aerospace, Transportation, Renewables, Lighting and Medical industries. He has co-authored 40 peer reviewed publications and has 29 US patents granted. He has served as the Industry Liaison on the IEEE Power Electronics Society's Administrative Committee. He is the recipient of the GE

Hero of Growth award, which “recognize some of the great leaders who are doing amazing things for the company.”

Dr. Stevanovic received the Dipl. Eng. degree in Electrical Engineering from Belgrade University, Serbia, in 1988, and earned his M.S. and Ph.D. degrees in Power Electronics from California Institute of Technology in 1989 and 1995, respectively.



Jeff Casady

Business Development and Program Management
CREE

Dr. Jeff Casady has 20+ years of semiconductor research, manufacturing, and marketing experience in a combination of industry / academic settings: Cree (NASDAQ: CREE), Northrop Grumman (NYSE: NOC), SemiSouth Laboratories, Inc., University of Missouri, Auburn University, & Mississippi State University.

Dr. Casady has published over 76 technical publications, three book chapters, and been an inventor or co-inventor on seven patents, all in SiC device development. He began his involvement with SiC power device development in 1994. From 2012 through today Dr. Casady is working for Cree, in various roles including SiC Product Management, SiC Power Marketing Director, and his current position in Business Development and Program Management. He contributes regularly to trade journal articles, program management, and public presentations on new SiC power products and applications. From 2003-12, Dr. Casady served as a corporate officer of SemiSouth, a small private company focused on SiC power device development and manufacturing. He served in roles including CEO, CTO, and VP of Business Development. During his tenure there over \$70 M of private investment was raised, over \$25 M of government contracts were won, and commercial revenue was increased dramatically. From 1999-2003, he served as an Assistant Professor of Electrical Engineering at Mississippi State University while helping to found SemiSouth and being active in several SiC power development programs at the University.

Dr. Casady previously worked for Northrop Grumman Science and Technology Center on several key projects from 1996-99, including the development of high-frequency S-band and L-band SiC SITs for pulsed, narrow-band, high-power radar applications (both ground-based and airborne). He also designed and fabricated some of the first SiC power switches, including thyristor/MOSFET based switches in the 1990's, and received marketing and project management training while there.

Dr. Casady holds a Ph.D. in Electrical Engineering from Auburn University, and graduate and undergraduate degrees from the University of Missouri.



Ranbir Singh
Founder
GeneSiC Semiconductor Inc.

Dr. Ranbir Singh, received a Ph.D. and MS degrees in Electrical and Computer Engineering, North Carolina State University, Raleigh, NC, and B. Tech from Indian Institute of Technology, Delhi. He founded GeneSiC Semiconductor Inc. in 2004. Prior to that he conducted research on SiC power devices first at Cree Inc, and then at the NIST, Gaithersburg, MD. In 2012, EE Times named Dr. Singh as among "Forty Innovators building the foundations of next generation electronics industry." In 2011, he won the R&D100 award towards his efforts in commercializing 6.5kV SiC Thyristors. He has published over 130 journal and conference papers, is an author on 28 issued US patents, and has authored a book.



Anant Agarwal
Advisor, Wide Band Gap Initiative, EERE

Before joining EERE in March 2013, Dr. Agarwal was Director of Research and Development for Wide Band Gap devices, and in particular, Silicon Carbide based power devices and their commercialization, at Cree, Inc. As a leading research scientist in this area, Dr. Agarwal's lifelong goal has been to successfully commercialize Wide Band Gap power devices to resurrect the domestic Power Electronics Industry and bring high quality manufacturing jobs back to US while reducing energy consumption and greenhouse gases. He had been with Cree since 1999. In this position, he has led his research team to successfully commercialize Silicon Carbide Power Diodes and MOSFETs, which are being extensively used to improve efficiency and reduce power consumption, worldwide, in systems such as power supplies, solar inverters, LED lighting and motor drives. Future applications in Grid based electronics are not far behind.

Previously, Dr. Agarwal was a Fellow at Northrop Grumman Science and Technology Center, Pittsburgh (1990-1999) where, he led research on radio frequency Silicon and Silicon-Germanium

transistors and helped solve a large number of fundamental issues with Wide Band Gap technology.

Prior to joining Northrop Grumman, Dr. Agarwal had held various teaching and research positions (1984-1990) including Associate Professor in Allahabad, India and Member of Technical Staff at AT&T Bell Laboratories, Murray Hill, NJ where he was engaged in developing Gallium-Arsenide digital circuits for fiber-optic communications.

Dr. Agarwal received his PhD degree in Electrical Engineering from Lehigh University, Pa in 1984; Masters degree in Electrical Engineering from University of Tennessee Space Institute (UTSI) in 1980; and Bachelor of Science in Electrical Engineering from University of Allahabad, India in 1978. He jointly holds 38 patents, has co-authored more than 280 research papers in conferences and journals, co-edited a book on Silicon Carbide Technology, co-authored five book chapters and was elected an IEEE Fellow in January 2012 for his all-time contributions to Wide Band Gap technology.



Sharon Beerman-Curtin

Program Manager – Renewable and Alternative Energy Programs
Sea Warfare and Weapons Department
Office of Naval Research

Sharon Beermann-Curtin is Technical Lead for Power and Energy at the Office of Naval Research, serving as the focal point for power systems and alternative fuels that will enable the Navy to maintain superiority through improving shipboard energy density and system efficiencies. She is responsible for the Electric Ship R&D Consortium (ESRDC) and is the working group lead for the ONR Future Naval Capabilities Power & Energy Pillar. Ms. Beermann-Curtin was a Program Manager at the Defense Advanced Research Projects Agency (DARPA) in both the Defense Systems Office (DSO) and the Microsystems Technology Office (MTO) from 2004-2009. Her DARPA portfolio of programs focused on power and energy generation and electrical system components including batteries, fuel cells, high power capacitors, high power semiconductors (Silicon Carbide based), and biofuels through chemical synthesis (sunlight to fuel).

In 2002-2003 she was a visiting scholar in the Massachusetts Institute of Technology (MIT) Ocean Engineering Department (13-A program). From 1999-2001 she was the Chief Technology Officer for the Program Executive Office – Aircraft Carriers responsible for the transition of new technologies to both in-service and future Aircraft Carriers. Other positions held at ONR include Acting Deputy Department Head of the Materials and Physicals Sciences, and Ship Hull Mechanical & Electrical Science & Technology Department, Technology Manager for Ship Systems in the Hull, Mechanical and Electrical S&T Division, and Underwater Weapons Countermeasures Program Manager. IN 2009-2010 she was assigned overseas researching the state of power & energy technologies in Europe.