Nanotechnology Preeminent Team Faculty Seminar

March 30, 2017 @ 3:30pm

BRK, ROOM 1001

Dr. Anant Agarwal

Title: History of SiC Power Devices and a Vision for the Future

Bio: Dr. Agarwal joined the US Department of Energy (DOE) in March 2013, retiring in November 2016. While at DOE, Dr. Agarwal helped create and manage four programs related to wide band-gap technology and their applications including *PowerAmerica*, Next Generation of Electric Machines (I and II) and Graduate Traineeships. From 1999 to 2013, Dr. Agarwal was Director of Research and Development for Wide Band Gap (WBG) devices at Cree, Inc. In this role, he oversaw the development and commercialization of Silicon Carbide diode and MOSFET power devices.

Previously, Dr. Agarwal was a Fellow at Northrop Grumman Science and Technology Center, Pittsburgh (1990-1999). While at Northrop Grumman, he led research activities on radio frequency Silicon and Silicon-Germanium transistors. He was also instrumental in solving a large number of technical issues relating to WBG technologies.

Prior to joining Northrop Grumman, Dr. Agarwal held various teaching and research positions (1984-1990) including Associate Professor in Allahabad, India and Member of the Technical Staff at AT&T Bell Laboratories, Murray Hill, NJ. While at Bell Labs he was involved in the development of 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 MNR Engineering College, University of Allahabad, India in 1978. He jointly holds more than 60 patents, has co-authored more than 300 research papers, co-edited a book on Silicon Carbide Technology, co-authored five book chapters and was elected an IEEE Fellow in January 2012 for his contributions to Wide Band Gap technologies.

As a leading research scientist in this area, Dr. Agarwal's goal has been to successfully commercialize WBG power devices to resurrect the domestic power electronics industry while educating the next generation of researchers. This will ultimately enable the creation of high quality manufacturing jobs in the US.

Abstract: Silicon carbide power devices have undergone substantial development activities over the past 25 years. Today, these devices have been commercialized and are poised to replace silicon power devices in many applications over the next decade. Two conditions need to be met for the wide-spread adoption of silicon carbide power devices: (1) The cost of silicon carbide power devices is dramatically reduced, and (2) A large work force is educated to exploit the attributes of the SiC power devices in power electronics.

We will discuss technical issues that have been solved to date and new problems that will need to be addressed to enable the further adoption of silicon carbide devices. The technical challenges associated with the development of 10-40 kV SiC Insulated Gate Bipolar Transistors (IGBTs) will also be considered.

Additionally, a vision for the future will be presented, in which, the role of students and university researchers will play a critical role in the expansion of SiC power devices and applications. Future funding opportunities, collaborations with industrial partners and leveraging the university cleanroom facilities will be explored. In this context, we will briefly discuss programs, which I helped create and manage at the US Department of Energy: (1) *PowerAmerica*, (2) Next Generation of Electric Machines I-II, and Graduate Traineeships in Power Electronics.