<u>Prof. Bodh Raj Mehta</u>

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Introduction to speaker:

Prof. Bodh Raj Mehta is currently Professor of Physics and Schlumberger Chair Professor of Semiconductor Physics at Indian Institute of Technology Delhi, New Delhi, India. He did his M.Sc. in Physics from Punjabi University Patiala, M. Tech in Solid State Materials and Ph. D in Physics from IIT Delhi. He has worked as post-doctoral fellow at University of British Columbia, Canada; guest scientist at University of Saarbrucken, Germany; and guest professor at University of Duisburg, Germany. His major research interests are; Science and Technology of Thin Films and Nanostructured Materials for Solar Cell, Resistive Memory, Thermoelectric and Gas Sensor Devices. He is the recipient of MRSI Medal (Material Research Society of India, 2002), DAAD Fellowship (Deutscher Akademischer Austausch Dienst, 2000) and Marie Curie International Fellowship (European Commission, 2006). He is on the Editorial Board of Journal of Nanoscience and Nanotechnology and has about 160 journal publications. He is the Coordinator of the Unit on Nanoscience (Nanomission) at IIT Delhi; Co-coordinator of Nano Research Facility at IIT Delhi. One of his projects NanoSwitch has been selected by European Commission as a Success Story project.

Title:

"KPFM based nanoscale investigations of 2D-3D interfaces"

Abstract :

Junctions between two dissimilar materials have been a topic of significant research interest due to novel interface physics and its direct importance on device performance due to the influence of defect states, structural and electronic discontinuities. Due to atomically thin semiconductor layer in 2D-3D semiconductors, investigating and understanding the nature of interface and its influence on the device characteristics becomes even more complex and intriguing. In this presentation, the influence of 2D-3D interfaces on the device characteristics of G-Si solar cell, MoS_2-ZnS intermediate band gap semiconductor and MoS_2-Bi_2Te_3 thermoelectric devices will be discussed. In the first example, graphene layers prepared by CVD method have been used as a top layer in p-n silicon junctions and an increase in efficiency from 5.3% to 8.9% is observed. Surface potential changes at the graphene -Si junctions in surface and junction modes have been examined using Kelvin probe force microscopy investigations. Voc nanoscale maps derived from these measurements show that topographical impurities and wrinkled boundaries on the graphene surface affect affecting junction performance. In another study, patterned MoS_2 2D layers having feature size varying from 10 um to 1 um have been grown by a combination of stencil lithography and magnetron sputtering technique. Composite layers having wide band gap ZnS films and 2D MoS_2 layers show increased interface voltage due to 2D character. In the third example, the influence of n-n and n-p interfaces in MoS_2-Bi_2Te_3 and MoS_2-Sb_2Te_3 devices on the electron and phonon scattering resulting in improved thermoelectric properties will be discussed. It is shown that due to limited thickness of the 2D layer, there is a large accumulation of charge at the surface which modifies the current transport across the junction. These results are very important for understanding the basics physics issue related to 2D materials based junctions.