NANOHOUR & Nano-EP

Friday, September 27, 2013 at 2:00 pm
Beckman Institute - Room 2269

2-D Electronics with Transition Metal Dichalcogenides: Progress and Prospect

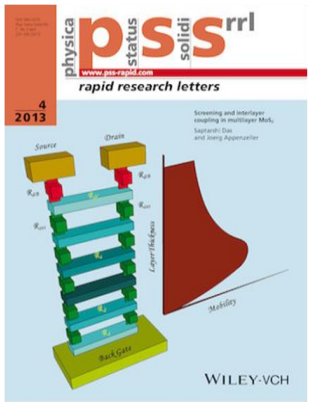
Saptarshi Das, Ph.D.

Postdoctoral Researcher, Center for Nanoscale Materials
Argonne National Laboratory

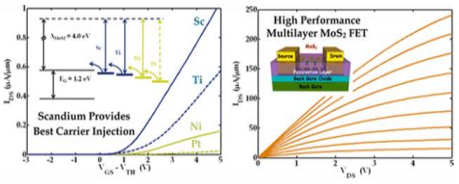
Low dimensional systems, by the virtue of their novel material properties and excellent electrostatic integrity, provide immense opportunities not only to explore fundamental physics but also to solve critical technological problems. One dimensional nanotubes, quasi one dimensional nanowires, two dimensional atomistically thin layered materials like graphene, hexagonal boron nitride and the more recently the rich family of transition metal di-chalcogenides (TMDs) comprising of MoS_2, WSe_2, $MoSe_2$ and many more are prime examples of such low dimensional systems. What makes the TMDs unique in this list is the fact that, in addition to their ultra-thin body, the d-orbital electrons of the transition metal atoms play an important role in determining the band structures of the TMDs which is assumed to be responsible for their extreme sensitivity to external forces like temperature, pressure, strain, light and charge.

In my talk I will first discuss how to connect these two dimensional ultra-thin TMDs to the "outside" world through ideal three dimensional metal contacts in order to capitalize on their ultimate potential. Then I will provide experimental evidences that strongly suggest the feasibility of aggressive channel length scaling of field effect transistors (FET) based on TMDs beyond the 10nm CMOS technology node. I will also demonstrate Schottky barrier tunneling phenomenon in back gated MoS_2 FETs and band to band tunneling phenomenon in partially top gated WSe_2 FETs, which will facilitate the implementation of TMDs for ultra-low power electronics. And finally I will show the effect of temperature, pressure, strain and light on the transport properties of the TMDs which can potentially shift the paradigm of conventional electronics.

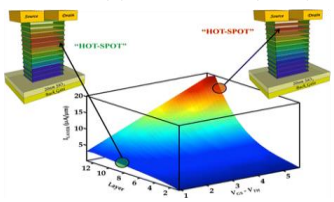
Cover Article
S. Das, et al. ***Rapid Research Letters*** 7, 268-273, (2013).



Das, S. *et al.* ***Nano letters*** 13 (1), 100–105 (2013).



Das, S. *et al.* ***Nano letters*** 13 (7), 3396–3402 (2013).



Coffee and cookies will be served
http://nanohour.beckman.illinois.edu