Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad – 500 046

Students' Annual Seminar

Tuning Large Area MoS_2 Monolayers for Electronic and Spintronic Applications

Dipak Maity

Two-dimensional transition-metal dichalcogenide (TMDC) semiconductors like MoS_2 hold promise for next-gen devices, yet face hurdles in industrial applications due to imperfections of wafer-scale deposition techniques and contact impedance issues. On the other hand, monolayer MoS_2's high Spin-Orbit Coupling (SOC) and inherent broken spatial inversion symmetry hold promise for valleytronics, while magnetic dopants bringing long range magnetic ordering can introduce time-reversal symmetry breaking too. During the last one year, our research was trying to address some such problems by optimising the growth conditions and controlling dopant concentrations. We could successfully grew large-scale monolayer MoS_2 (5mm*5mm) using a modified CVD setup, exhibiting enhanced electron transfer characteristics. Moreover, we demonstrated an approach where we addressed the high Schottky barrier height (SBH) of conventional metallic contact Au/MoS_2 (~215 meV) junction by introducing an interfacial layer of degenerately-doped monolayer of MoS_2 (9 atomic% V doped MoS_2, V-MoS_2), thereby reducing the SBH to (~99 meV). The magnetic ordering along with enhanced electron transfer characteristics of V-MoS_2 makes it a suitable candidate for spintronic applications. Potential of MoS_2 in conjunction with other protective layers such as fluorographene in strain dependent photodetector applications is also attempted, and will be briefly discussed.

Wednesday, Mar 20th 2024

11:30 Hrs (Tea / Coffee 11:15 Hrs)

Seminar Hall, TIFR-H