Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad - 500107

Seminar

Exploring Atomic Layers based Hybrid 2D Materials for Photocatalysis and Photodetection

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Two dimensional (2D) layered semiconductor atomic layers, such as transition metal dichalcogenides (MX_2, where M=Mo, W etc, and X=S, Se, Te etc.) and their van der Waals (vdW) heterostructures have attracted considerable interest. Heterostructures with atomically sharp interfaces and alloyed versions of these exhibit widely tunable band gaps as a function of composition and stacking sequence. In this talk, I will demonstrate aberration corrected high angle annular dark field (HAADF) – scanning transmission electron microscopy (STEM) of MoS_2, WS_2 and their alloys with selenium 'Se' such as $MoS_{2(1-x)}Se_{2x}$ etc and their enhanced optical properties for visible light photoelectrocatalysis (PEC). Further, the recent achievements in fabrication and characterization of atom-by-atom 'Se' doping of MoS_2 and WS_2 atomic layers and seeding of platinum 147 (Pt_{147}) size selected nanoclusters on WS_2 atomic layers using cluster beam deposition. Pt_{147} atomic clusters were deposited at 0.1 eV per atom kinetic energy with and without Ar ion defects on WS_2 atomic layers for the first time. The statistical analysis and morphological features of size distribution and defect mediated seeding of Pt_{147} clusters are quantified using HAADF–STEM and complimented with Raman/photoluminescence (PL). Layer dependency and defect mediated interaction of Pt_{147} clusters on WS_2 is quantitatively estimated from HAADF–STEM intensity profiles. Furthermore, electrochemical Hydrogen Evolution Reaction Activity (HER) of WS_2 and WS_2-Pt_{147} clusters before and after electrochemical activity will be discussed. These kind of 2D and 0D nanocluster hybrids are very good candidates for the catalysis and energy harvesting applications.

Friday, Oct 25th 2019

11:30 AM (Tea/Coffee at 11:00 AM)

Seminar Hall, TIFR-H