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

Internal Seminar

Electrical, magnetotransport and spin transport studies in wide bandgap oxide semiconductor thin films and heterostructures

Joynarayan Mukherjee

IIT-M, Chennai

Wide bandgap oxide semiconductors are promising materials for optoelectronic devices. Most of these oxides such as ZnO, $InGaZnO_4$, In_2O_3 etc. exhibit n-type conduction due to presence of native defects. Electrical conductivity in these oxides can be tuned over a wide range by doping different elements. Thickness of the film plays a significant role on conductivity of a system. We have studied the effect of thickness on transport properties of Ga:ZnO films and observe thickness dependent metal insulator transition (MIT). Magnetotransport measurement and density functional theory (DFT) calculations further confirm the MIT. We have experimentally investigated the flow of a pure spin current through ultrathin Ga:ZnO layer sandwiched between an insulating bismuth doped yttrium iron garnet (Bi:YIG) layer and a platinum (Pt) layer via SMR measurements. The observed SMR amplitude is reduced when inserting Ga:ZnO layer between Pt and Bi:YIG.

Amorphous $InGaZnO_4$ (a-IGZO) is another excellent material for thin film transistors (TFTs) owing to high mobility (>10 cm^2/v-s). We have also studied disorder dependent MIT in a-IGZO thin films. From the magnetoresistance experiment, phase coherence length was estimated. Phase coherence length scales with temperature as $T^{-3/4}$ confirming that the electron-electron scattering dominates the dephasing mechanism.

Monday, Oct 23rd 2017

02:00 PM (Tea/Coffee at 01:45 PM)

Auditorium, TIFR (FReT-B)