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

Seminar

Robust molecular exchange-bias effect, magnetisation switching dynamics and topological Hall physics at ferromagnet/molecule interface

Suman

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The choice of using organic molecules as building blocks in nano-spin electronics has triggered research in the area of molecular spintronics. This research interest has arisen due to additional functionalities of organic molecules over inorganic materials, such as flexibility, tunability, self-assembly on surfaces, large spin relaxation time and photoelectric properties. When these molecules are deposited on a clean magnetic surface, they give rise to new hybridised bonding and antibonding states at the interface, leading to many exciting results, such as an increase or decrease of magnetic exchange coupling and magnetic hardening or softening effect. The extreme case of magnetic hardening can lead to the exchange bias effect, which has spintronic applications in magnetic data storage read heads and spin-valve sensors. In this talk, I will report an interface study between thin films of Fe and monolayer metal phthalocyanine molecules showing a robust exchange bias effect, which provides evidence that the magnetic hardening effect is the underlying reason behind molecular exchange bias in our devices. Next, I will discuss magneto-transport studies using planar Hall measurement, which indicate that the magnetisation switching happens through non-co-planar spin configuration in Fe/Vanadyl phthalocyanine (VOPc) system. Further, I will describe the second magnetic system, Chromium Telluride (CT), which exhibits the potential of tailoring magnetic anisotropy by varying the Cr to Te ratio. Additionally, I will discuss the Hall study of CT/VOPc devices, elucidating the stabilisation of non-coplanar spin textures at the interface, which is supported by the observation of the topological Hall effect. This work provides direct evidence of the manipulation of interfacial Dzyaloshinskii-Moriya interactions (DMI) at the CT surface as a result of molecular adsorption.

Monday, Oct 30th 2023

11:00 AM (Tea / Coffee 10.45 AM)

Auditorium, TIFR-H