Guest Editorial

A fundamental theme of research in condensed matter physics has been to understand the macroscopic behaviour of solids such as superconductivity, magnetism, optical response, etc. in the framework of their electronic structures. The motion and distribution of electrons are governed by the laws of quantum mechanics and involve a challenging many-body problem. In several materials like semiconductors, this can be simplified reliably by treating electrons as independent of other electrons, but moving in an effective total potential. On the other hand, some materials exhibit properties like high T_c superconductivity, metal–insulator transition, half metallicity etc. which involve highly coupled quantum motion of many electrons that cannot be explained within a picture of independent electrons. They are known as strongly correlated electronic systems, and determination and understanding of their electronic structures are still challenging. Interestingly, extensive work in the last couple of decades has shown that electronic structure depends sensitively on the size and shape of a material, particularly in the nanoscale where the de Broglie wavelength of an electron is comparable to the size or other physical length scales. This has often been used to tune material properties for functional applications. In addition, new types of electronic phenomena can emerge at nanoscale due to the boundary conditions that confine electrons dimensionally. Indeed, experiments and computer simulations form a powerful combination of complementary tools in uncovering the electronic physics of a rather broad spectrum of phenomena in correlated bulk as well as in nanoscale materials, which is evident for example, in Prof. D D Sarma's research.

In this issue, we have invited reviews on the electronic structure of materials including strongly correlated electronic materials and nanoscale structures. Maiti's article provides a review of the experimental analysis of electronic structure of superconductors coupled with a magnetic element like Fe. Paul and Raj discuss the metal–insulator transition in sodium tungsten bronzes using experimental methods like ARPES and first-principles calculations based on full potential LAPW methods. Stimulated by many debates, efforts to understand the effects of the insulating tunnelling barrier on the magnetoresistance of double perovskites are reviewed by Nag and Ray. The physics of magnetocaloric effect in materials with coupled electronic spins and lattice degrees of freedom, specifically in rare-earth intermetallics is reviewed by Nirmala *et al.* The correlation between a cation dopant site of perovskite $SrTiO_3$ and its dielectric properties is discussed by Choudhury using complementary analysis based on experimental and theoretical tools. Manju's article presents a review of the evolution of the correlation effects on the two-dimensional surface alloys. Mahantha and Menon review the effects of quantum confinement on the growth of Cu, Ag and Au on a graphite substrate using ARPES and LEED. Topwal's article provides an analysis of the effects of electron confinement in ultrathin films and nanowires on semiconductor and metallic substrates through band mapping. Das and Mahadevan's article presents first-principles calculations to determine the effect of strain on the electronic structure and possible metal–semiconductor transition in monolayer of

$MoSe_2$. Various mechanisms of the deformation of nanoparticles are reviewed by Gerard and Pizzagalli. The growth of CdTe nanocrystals using digestive ripening is reviewed by Mittal and Sapra. Viswanatha reviews the effects of 3*d* transition metal dopant on the electronic structure of three-dimensionally confined nanocrystals. Mahadevu *et al* discuss the progress made towards assembling nanoscale building blocks into functional materials. Following these reviews on the fundamental understanding of electronic behaviour, there are reviews dedicated to its applications. Nanda *et al* discuss the role of size in revolutionizing the electrochemical energy storage in Li ion based batteries. Tandon *et al* review the introduction of new transparent conducting oxide nanocrystals for plasmonic applications. The use of carbon-based nanostructures for electromagnetic shielding is reviewed by Joshi and Datar.

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