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Thursday Colloquium

on

04th March, 2010 at 3 pm in the

Seminar Room, Biophysics Department, (Behind Ranade Bhawan)

on

Physics of Nanomaterials

by

Professor Pushan Ayyub

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All are cordially invited.

Abstract

Most of the physical properties of a solid get modified – often drastically – when the particle or crystallite size is reduced below certain characteristic length scales, which usually fall in the 1-100 nanometer regime. Important properties that are markedly affected include magnetism, ferroelectricity, superconductivity, optical and electronic properties as well as the crystal structure. With a decrease in crystallite size, certain properties show exciting improvements while others might get completely degraded. In order to optimally utilize nanomaterials for the next generation of devices, it is essential to achieve a reasonable understanding of the physical mechanisms that govern the particle size dependence of various physical properties.

Size-induced changes in most physico-chemical properties can be ascribed to one (or more) of the following origins: (1) quantum size effects, (2) surface and interface effects, and (3) size-induced modifications in the lattice symmetry. I will introduce these topics and provide examples of each category drawn from our research on different types of nanomaterials. Thus, the evolution of superconductivity with size in many conventional superconductors can be satisfactorily explained by quantum size effects. The role of surface effects in (a) determining the colour of nanocrystalline thin films, and (b) in promoting enhanced coupling of intense laser beams to a nanocrystalline surface would be discussed. Finally, size-induced changes in crystal symmetry will be shown to be responsible for the destabilization of ferroelectricity in nanocrystalline oxides. The stabilization of various novel and unusual crystallographic phases with a lowering of particle size would also be briefly discussed.

Yours sincerely,

(Dr. D.C.Kothari)