Seminar

Institute for Plasma Research

Title : Size and Shape Controlled $CoFe_2O_4$ Nanoparticles for Developments of Permanent Magnet Applications

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Venue : Online - Join the talk:
https://meet.ipr.res.in/Dr.YogendraKumar_PDFtalk

Abstract :

Nanoscience and nanotechnology are driving for globalization and commercialization of various technological applications. Nanoscience is the study of phenomena and manipulation of materials at atomic, molecular, and macromolecular scales, where properties differ significantly from bulk. Nanotechnology allows scientists, engineers, and chemists to design, characterize, and produce the application-oriented structures, devices, and systems by controlling shape and size of materials on the nanoscale level. It is noteworthy that the morphologies of nanomaterials play an important role in technological applications. The chemical and physical properties of materials are tailored by controlling their size and shape at nanoscale dimensions. Nowadays scientist and engineer have been devoted to prepare various nanostructures. There are different types of nanostructures e.g. nanoparticles, nanowires, nanorods, nanobelts, nanotubes, and so forth. These nanostructures influence the resulting properties of materials by precisely controlling the desired parameters. The electronic, optical and magnetic properties of materials at nanoscale dimensions are of great interest. Some example are; (a) electrical conductivity increases due to better ordering and ballistic transport, (b) optical absorption peak of semiconductor nanoparticles (NPs) shifts to shorter wavelength due to an increases in the band gap, (c) in spectra metallic NPs color change due to surface plasmons resonances, (d) mechanical strength enhances simply as size decreases due to reduced probability of defects, and (e) increased selectivity and reactivity in catalysis as size decreased. The range of applications, where the size and shape of the particle can enhance properties, is extremely wide and useful for various technological applications.

In case of magnetic materials, nanoscale size plays a vital role in determining the uniqueness and novelty of material properties such as saturation magnetization (Ms), remanent magnetization (Mr), coercivity (Hc), and magnetocrystalline anisotropy. The magnetic single domain and superparamagnetism are some of the unique features of magnetic NPs at nanoscale dimensions. Magnetic NPs have drawn the remarkable attention in several disciplines such as life sciences, chemistry, physics, and materials science, because of their capabilities in different technological applications. Because of the widespread applications of magnetic NPs in various fields, it is of great interest to develop different kinds of magnetic NPs. The designing of monodisperse magnetic NPs with controlled size and shape is essential not only to understand the morphology dependent physicochemical properties but also imperative for state of the art applications.