Seminar

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Institute for Plasma Research

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Title: The Perfect Blend: How Phase Connectivity Shapes Magnetoelectric Composites

Speaker: Dr. Mohan Subramaniam
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Date: 4th April 2025 (Friday)

Time: 03.30 PM

Venue: Seminar Hall, IPR

Abstract

Magnetoelectric (ME) composites, combining ferromagnetic and ferroelectric phases, exhibit significantly enhanced ME coupling at room temperature compared to single-phase materials. Among various composite geometries, 0-3 particulate structures offer processing advantages; however, their ME coefficients often fall below theoretical expectations due to microstructural factors and interface characteristics.

In this talk, I will discuss the influence of particle size, sintering parameters, and phase connectivity on the structural, magnetic, magnetostrictive, dielectric, and magnetodielectric properties of CoFe2O4–BaTiO3 0-3 composites. I will present structural analysis results confirming the formation of barium hexaferrite as an impurity phase due to cross-reactions at grain boundaries, which may impact ME coupling. Additionally, I will highlight magnetization studies showing a decrease in Curie temperature and saturation magnetization with increasing sintering temperature and BaTiO3 content attributed to compositional modifications in CoFe2O4.

Furthermore, I will discuss how composites near the percolation threshold exhibit enhanced magnetostriction and dielectric performance. I will also explore the role of ferrite nanoparticles, which improve magnetostriction strain due to reduced grain size, optimizing the piezomagnetic contribution and magnetodielectric response. These findings emphasize the importance of phase connectivity and nanoparticle incorporation in designing high-performance ME composites.