ABSTRACT FOR SEMINAR

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Venue: Room D, ul. Piotrowo 3, Poznan University of Technology (PUT), Poznań, Poland

Presenter: Gulzar Hussain

Title: *Tailoring Functional Properties of $CoFe_2O_4$ and $BiFeO_3$ Nanocomposites Using Liquid Crystals and Graphene Nanoplatelets for Energy Storage Applications*

This presentation highlights two series of advanced ferrite-based nanocomposites developed for multifunctional applications in electronic and energy storage technologies. The first study focuses on cobalt ferrite ($CoFe_2O_4$, CFO) nanocomposites incorporating different concentrations of liquid crystals (LCs). In contrast, the second study investigates rare-earth-substituted bismuth ferrite ($BiFeO_3$) nanocomposites modified with varying concentrations of graphene nanoplatelets (GNPs) and a fixed amount of LCs. The nanocomposites were synthesized using auto-combustion and ultrasonication techniques to achieve homogeneous distribution, controlled morphology, and improved physicochemical properties. A wide range of characterization methods was employed to examine the structural, morphological, optical, dielectric, magnetic, and electrochemical behavior of the prepared nanocomposites. Structural and phase analyses were performed using X-ray diffraction (XRD), while surface morphology and particle distribution were investigated using scanning electron microscopy (SEM), transmission electron microscopy (TEM), energy-dispersive X-ray spectroscopy (EDS), and atomic force microscopy (AFM). Furthermore, optical, dielectric, magnetic, and electrochemical studies were performed to evaluate the multifunctional performance of the synthesized materials. The detailed experimental results, comparative analyses, and discussion of the obtained properties will be presented in the slides. The investigated nanocomposites exhibit significant potential for tunable electronic and magnetic behavior, enhanced dielectric response, and improved electrochemical performance, making them promising candidates for high-frequency electronic devices, memory systems, sensors, and next-generation energy storage applications.

Keywords:
$BiFeO_3$ nanocomposites; $CoFe_2O_4$; dielectric properties; energy storage; graphene nanoplatelets; liquid crystals