Seminar

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Institute for Plasma Research

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Title: Exploring Cobalt Ferrite for Potential Applications in Radiation and Magnetic Field Detection

Speaker: Dr. Krishnamayee Bhoi
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Date: 09th June 2025 (Monday)

Time: 02:30 PM

Venue: Seminar Hall, IPR

Abstract

Ceramics are viable candidates for various applications such as electrical insulation, thermal insulation, blankets and windows in fusion devices and nuclear environment. The engineering applications of magnetic materials include magnetic core of transformers, motors, inductors, permanent magnets etc. Thus the magnetic materials are already inevitable part of important systems in variety of engineering and technological systems, relevant for fusion energy applications. The most widely used ceramics in fusion radiation environments include Al_2O_3, $MgAl_2O_4$, BeO, Si_3N_3, and SiC. However, the search for new materials, improvement in their properties, and ensuring their sustainability in nuclear radiation environments remain ongoing challenges.

Cobalt ferrite ($CoFe_2O_4$, CFO), a spinel ferrite displays excellent chemical and thermal stability, promising electrical and magnetic properties offer its applications in microwave absorption, gamma-ray shielding, sensors etc. In this work, phase pure CFO and manganese (Mn) modified CFO was synthesized. The effect of manganese (Mn) substitution on the structural, vibrational, magnetic, and electrical properties of CFO was investigated. The incorporation of the modified CFO (as magnetic element) in ferroelectric polymer matrix enables the use of magneto-electric (ME) effect for potential application in magnetic field sensor. The ME effect promises extra degree of freedom in device operation. The magnetic field sensor utilizing ME effect will be further explored. The effect of neutron irradiation on the CFO and modified CFO sample will also be further investigated as a future work as neutron irradiation is reported to change the structural, electrical, and magnetic properties in this type of materials. The synthesis, various characterizations, followed by their results and discussions, along with future perspectives i.e. the effect of neutron irradiation and the fabrication of magnetic field sensor will be presented in the seminar.