

## Structural, Magnetic, and Dielectric Studies of Tetragonally Ordered $\text{Sm}_2\text{Fe}_2\text{O}_7$ Pyrochlore Nanostructures for Spintronic Application

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**Abstract :** Understanding the structural, electronic, and magnetic properties of nanomaterials is essential for developing next-generation electronic and spintronic devices, contributing to the progress of nanoscience and nanotechnology applications. Multiferroic materials, with intimately coupled ferroic-order parameters, are widely considered to breed fascinating physical properties and provide unique opportunities for the development of next-generation devices, like multistate non-volatile memory. In this study, we are set to investigate the structural, electronic, and magnetic properties of the frustrated  $\text{Fe}^{\text{II}}/\text{Sm}^{\text{VI}}$  sublattice in relation to the widely studied perovskites for spintronics applications. The atomic composition, microstructure, crystallography, magnetization, thermal, and dielectric properties of a pyrochlore  $\text{Sm}_2\text{Fe}_2\text{O}_7$  system synthesized using sol-gel methods are currently being investigated. Precursor powders were dissolved in citric acid monohydrate to obtain a solution. The obtained solution was stirred and heated using a magnetic stirrer to obtain the gel phase. Then, the gel was dried at  $200^\circ\text{C}$  to remove water and organic compounds and form an orange powder. The X-ray diffraction analysis confirms that the structure crystallized as a pyrochlore structure with a tetragonal  $F4mm (107)$  symmetry. The presence of  $\text{Fe}^{3+}/\text{Fe}^{4+}$  mixed states is also revealed by XPS analysis.

**Keywords :** nanostructures, multiferroic materials, pyrochlores, spintronics

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