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Magnetic Studies of Sr and Sn Doped $BaFe_{12}O_{19}$ Nanoparticles: Sustainable Synthesis for Spintronics Applications

In this study, we synthesize $BaFe_{12}O_{19}$ (BaM) using the hydrothermal method with various combinational doping of Sr and Sn via the combinational analysis (1-X).(1-y).x.y, exploring both X=Y and X≠Y configurations. $BaFe_{12}O_{19}$ is known for its potential in spintronics applications, particularly as a candidate for high-density magnetic storage and microwave devices due to its high coercivity, magnetic anisotropy, and thermal stability. We adopt a sustainable approach in this research, aiming to minimize environmental impact while synthesizing and studying the material. We systematically investigate the structural, magnetic, and electronic properties of these doped samples through fundamental characterizations, including X-ray diffraction (XRD) for phase identification and crystal structure analysis, Scanning Electron Microscopy (SEM) for surface morphology and particle size determination, and Vibrating Sample Magnetometry (VSM) for magnetic property assessment. Additionally, we perform Mössbauer spectroscopy to analyze hyperfine interactions and electron spin resonance (ESR) to investigate the magnetic dynamics. These analyses determine how Sr and Sn doping influences the magnetic properties and spin dynamics of $BaFe_{12}O_{19}$, contributing to its potential application in spintronics

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