

Abstract 1 – Paper ID: 025**Calcination Temperature–Modulated Structural, Magnetic, and Optical Properties of BiFeO₃**

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Abstract

The narrow temperature range of phase stabilization has limited the successful synthesis of pure phase bismuth ferrite. Bismuth ferrite (BFO) has been synthesized using a facile sol–gel route by calcining the as–prepared BFO powder at different temperatures of 350°C, 450°C, 550°C, 600°C and 650°C. The influence of temperature variation on the structural, magnetic, and optical properties of BFO has been investigated. XRD patterns show the characteristic peaks of pure BFO along with secondary phases like Bi₂Fe₄O₉, Bi₂₅FeO₄₀, and Bi₂O₃ in all the samples calcined at different temperatures. Leaching with 1 M HNO₃ followed by subsequent washing has been employed as an efficient route to remove the impurity peaks. XRD and Rietveld Refinement analysis of the leached samples confirmed the phase formation of pure BFO with no extra peaks. Crystal growth with increase in temperature could be observed from the morphology investigated through FESEM. Stretching and bending vibrations of Fe–O and Bi–O bonds have been confirmed from FTIR. The influence of calcination temperatures on magnetic properties is analysed from M–H loop revealing the presence of weak ferromagnetism in the synthesized BFO nanoparticles. The UV–V is spectroscopy measured the optical band gap of the samples which could be tuned in the visible region and can ultimately be exploited for applications in photocatalysis and photovoltaic devices.

Keywords: Sol-gel, Rietveld Refinement, FESEM, Magnetization, Ferromagnetism, Band Gap