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An investigation of the structural and magnetic properties of Ho substituted BiFeO₃

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Abstract content
   (Max 300 words)

The doping of BiFeO₃ with lanthanide elements like Ho, with a radius smaller than Bi, is ideal to improve the ferroelectric and magnetic properties of BiFeO₃, which in principle can cause structural distortions of the lattice that can enhance the electrical and magnetic [1] properties. In this paper, we report on the temperature dependence of the structural and magnetic properties of Ho substituted BiFeO3 (BHFO) which has been investigated by Mössbauer spectroscopy and X-ray diffraction (XRD). Mössbauer measurements were performed in-situ (300 – 748 K) on the as-synthesized BHFO sample.

The Mössbauer spectra were characterized by broadened features and the magnetic hyperfine splitting patterns, which are indicative of magnetic ordering mostly probably screwed or slightly antiferromagnetic ordering. The room temperature spectrum was fitted with two superimposed symmetric sextets, with similar hyperfine magnetic fields of Bhf1 = 50.1 T, and Bhf2 = 49.8 T in the Fe3+ state corresponding to rhombohedral BiFeO₃ (BFO) as observed by De Sitter et al. [2], a Lorentzian doublet which is attributed to the paramagnetic impurity phase Bi₂₅FeO₄₀ and a singlet which is a result of the minority Bi₂Fe₄O₉ impurity phase. The hyperfine fields of the sextet components decreased systematically with increasing temperature to a field distribution just below the Neel temperature. At temperatures, T > 588 K, the phase transitions are dominant and are attributed to the instability of BFO at such temperatures with weak reflections from the decomposition to the Bi₂₅FeO₄₀ and the Bi₂Fe₄O₉ impurity phases [3]. An average Debye temperature, ⊠D = 240 ⊠ 81 K has been determined for BHFO using the from the temperature dependence of spectral area fractions which is lower than that cited for BiFeO₃ [4].

References:

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