Nisha Francis P et al., J Phys Chem Biophys 2014, 4:5
http://dx.doi.org/10.4172/2161-0398.S1.008

OMICS Group Conferences
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2nd International Conference and Exhibition on
Lasers, Optics & Photonics
September 08-10, 2014 Hilton Philadelphia Airport, USA

Room temperature ferromagnetism in BiFeO3 nanoparticles synthesized by sol-gel technique

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Bismuth ferrite, BiFeO3 (BFO) one of the natural multiferroics is an antiferromagnetic, ferroelectric and ferroelastic material with electrical, magnetic and structural ordering temperatures well above the room temperature. BFO possesses distorted rhombohedral perovskite (ABO_3) structure with space group R3c with Curie (Tc~1110 K) and Neel (TN~640 K) temperatures. In the present work, nanoparticles of multi ferroic bismuth ferrite were synthesized following sol-gel technique using bismuth nitrate and iron nitrate as starting materials and citric acid as chelating agent. The precursor was calcined at 550°C for 2 hrs in air to obtain BFO powder. The rhombo hedral phase is identified by XRD and the parameters are in good agreement with JCPDS Card number 86-1518.The average crystallite size is 42 nm. FTIR spectra at 550 and 440 cm-1 are attributed to Fe-O stretching and O-Fe-O bending vibrations, the characteristics of the FeO_6 octahedra in Perovskites. BiO_6 octahedral structural unit also possesses vibrational frequency between 600 and 400 cm^{-1}. Surface morphology and compositional analysis were studied by FESEM with EDS. From the UV-visible absorption spectrum the bandgap is calculated as 2.13eV. Increasing absorption in the visible region and its narrow bandgap makes it a suitable candidate for photocatalytic activity. VSM details (M_s=0.1889 emu/g, H_c=78.278G) showed the hysteresis loop indicating ferromagnetic behavior of BFO nanoparticles at room temperature. The second harmonic generation efficiency of BFO is 0.89 times KDP.

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