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Synthesis and characterization of PVDF-$BiFeO_3$ nanocomposite films

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Pure phase Bismuth Ferrite $BiFeO_3$ (BFO) nanomaterial calcined at 500 ^oC for 2h is successfully synthesized by sol-gel method. The crystalline structure is confirmed by X-ray diffraction analysis. The Rietveld refinement of XRD pattern suggests that BFO has rhombohedral structure of space group R3c. The average particle size i.e, 37 nm (Figure 1a) is calculated from TEM image analysis. The Polyvinylidene fluoride and Bismuth Ferrite (PVDF-BFO) nanocomposites films with varying weight % (i.e, 0, 2 and 4wt %) of BFO are synthesized by drop casting method and characterize by using different characterization techniques.

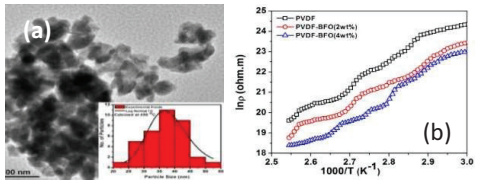

Figure 1: (a) TEM image of BiFeO3 nanomaterial, inset shows the particle size histogram. (b) Temperature dependent dc resistivity of PVDF-BFO composite films

XRD pattern showed the formation of β-phase and presence of BFO phase in PVDF-BFO nanocomposites films (Figure 2). Surface morphology of the composites films are seen by SEM analysis (Figure 3). Thermal behavior of PVDF-BFO nanocomposites is analyzed by DTA-TGA plot. DTA analysis showed that the two endothermic peaks obtained at temperature around 440K and 755K. The 1st peak showed the melting temperature and the 2nd peak showed the degradation temperature of composites films. TGA analysis showed that the thermal stability increased with increasing BFO wt%. The temperature dependent electrical properties (i.e, dielectric constant, resistivity and tangent loss) of PVDF-BFO nanocomposites are investigated from temperature range 300 to 400K (Figure 1b). The dielectric constant increased from 8.92 to 25.50 and 26.65 and the variation of electrical resistivity is from 24.32 to 23.40 and 22.98 Ω.m and the loss factor is varies from 0.03 to 0.02 and 0.01 for PVDF-BFO (0, 2 and 4wt %) respectively at room temperature.

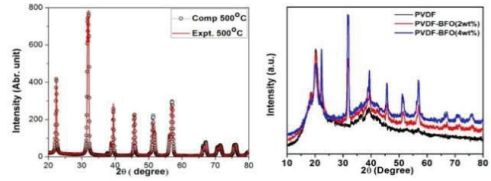

Figure 2: (a) XRD pattern of $BiFeO_3$ nanomaterial calcined at 500 ^oC and (b) XRD pattern of PVDF-BFO (0, 2 and 4wt %) composite films

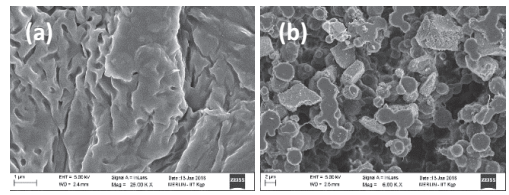

Figure 3: SEM image of (a) PVDF film and (b) PVDF-BFO(4wt%) composite film

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