Multiferroic samples with composition (1-x) BiFeO$_3$- (x) (Ba$_{0.70}$Sr$_{0.30}$)TiO$_3$ (BFO-BST) were synthesized using a sol-gel route to study the effect of BST doping on structural, transport and magnetic properties in BiFeO$_3$ (BFO). X-ray diffraction studies with Rietveld analysis revealed that a phase transition occurred rhombohedral ($R3c$) (0.0 £ x £ 0.15) to tetragonal ($P4mm$) for x = 0.20 and nanocrystalline nature confirmed by TEM measurements. Piezoelectric properties improved as x increased x = 0.0 (58 pC/N) to x = 0.20 (112 pC/N) increasing distortion in the crystal structure as evinced by Williamson-Hall (W-HH) analysis. Ferromagnetism was observed in doped BFO, different the antiferromagnetic ordering in bulk BFO, indicating the noteworthy size effects and Fe-O-Fe bond angle variations in the magnetic ordering of BFO. The influence of dopants on the optical properties is confirmed by using UV-visible spectroscopy, revealing a blue shift in band energy with increasing concentration of dopants. Thermally activated conduction behavior occurred at low and high temperature regions as revealed by temperature dependent dc resistivity measurement. Effective improvements in dielectric response meaning high dielectric constant with a low dielectric loss were found in the doped samples.

**Keywords:** Magnetic properties, Rietveld analysis, Dielectric properties

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