Title: Investigation of Structural, Optical, and Electrical Properties of Silver and Iron Doped Barium Titanate Thin Films Deposited by Spray Pyrolysis

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Abstract

In this work, Silver (Ag) and Iron (Fe) doped Barium Titanate ($BaTiO_3$) thin films have been deposited onto plain glass substrates at 300 ℃ using the spray pyrolysis method. The surface morphological, structural, optical, and electrical properties of Ag and Fe doped $BaTiO_3$ thin films have been investigated with doping concentrations of 0, 2, 4, 6, and 8 at.% of Ag and Fe. The surface morphology of these films has been observed by scanning electron microscopy (SEM). The X-ray diffraction (XRD) was used to study the structure and crystalline size of $BaTiO_3$ nanoparticles. The XRD pattern of pure and Ag doped $BaTiO_3$ thin films revealed that the different types of grain of hexagonal phase for pure and Ag doped $BaTiO_3$ thin films. The optical properties were studied using the UV-Visible spectroscopy in the wavelength range of 200-1200 nm. The calculated band gap for pure $BaTiO_3$ is found 2.80 eV and for 2, 4, 6 and 8 at. % Ag doped $BaTiO_3$ thin films are 2.04eV, 2.28eV, 2.22eV and 2.0eV, respectively. The hexagonal phase for $BaTiO_3$ turned into a tetragonal phase for Fe doped $BaTiO_3$ thin films. The evaluated band gaps are 2.79eV, 2.77eV, 2.57eV and 2.51eV for 2, 4, 6 and, 8 at. % Fe doped $BaTiO_3$ thin films. The electrical properties were also studied using the four-probe method. It explains the metallic nature of the pure, Ag, and Fe-doped $BaTiO_3$ thin films.