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## Structural and optical properties of spin coating ITO thin films

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Indium tin oxide (ITO) represents the famous and the most common transparent conductive oxide (TCO) due to its properties. In this paper, we successfully deposited indium tin oxide (ITO) thin films on glass substrates via sol-gel spin coating technique. The synthesized films were annealed at different temperatures ranging between 300-500 °C for 2 hours in air and gradually cooled down to the atmospheric temperature to achieve a high level of crystallinity and transmittance. Structural, morphological and optical properties of the films have been studied using X-ray diffraction (XRD) (Fig. 1), scanning electron microscopy (SEM) (Fig. 2) and UV-visible spectroscopic methods (Fig. 3). The XRD studies show that all of the films have cubic crystal structures. Grain size (calculated via Debye-Scherrer Method) increased from 10 to 22 nm as the annealing temperature was increased to 500 °C. The deposited films have a partially crystalline structure before annealing, which changes to a polycrystalline phase after annealing. Investigation of the surface morphology reveals that the thin films are homogeneous. The cross sectional SEM study shows that the thin film thickness is around 700 nm. UV-visible measurements indicate that the transparency of the films is significantly affected with annealing temperatures, and at 500 °C annealing the highest transparency attained was 90%.

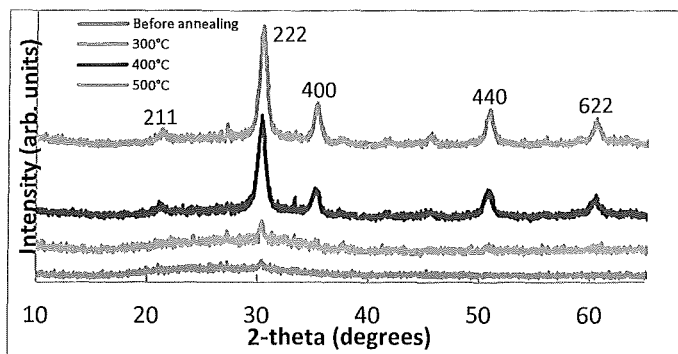


Figure 1. XRD pattern of ITO films annealed at different temperature

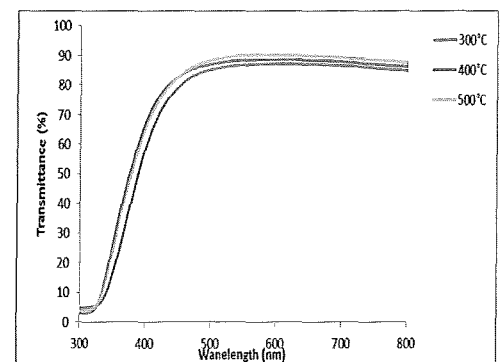


Figure 3. Transmittance spectra of ITO films

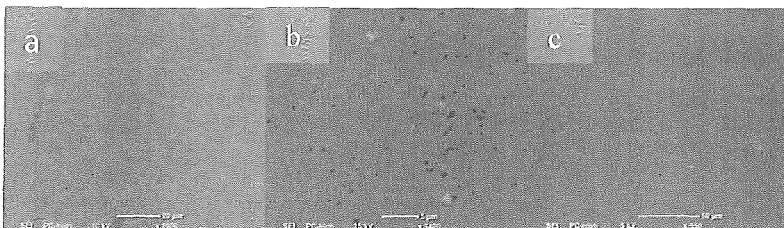


Figure 2. SEM images of ITO films  
a – at 300°C , b – at 400°C and c-at 500°C