Nanostructured surfaces

Annealing effect on the structural, optical and electrical properties of indium tin oxide thin films

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Transparent conductive oxide (TCO) thin films play an important role on many of applications such as transparent electrodes for optoelectronic devices, panel displays, solar cells and touch panels. In this study, indium tin oxide (ITO) thin films with 100 nm thickness were deposited onto glass substrates by radio frequency (RF) magnetron sputtering at room temperature with low Ar working pressure of 5×10^{-3} torr, and then through conventional furnace annealed in air ambience at different temperatures from 100 to 300ºC for 2 hrs. Annealing is an effective and widely procedure to promote crystallinity and physical properties of ITO thin films [1, 2]. The annealing temperature effect on the structural, optical and electrical properties of the ITO thin films was investigated by X-ray diffraction (XRD), UV-Vis-NIR spectrophotometer, and four-point measurements, respectively. From the XRD patterns shown in fig. (a), the (222) and (400) diffraction peaks of ITO were located at 30.5º and 35.4º, and the intensity of diffraction peaks increased with increasing annealing temperature. On the other hand, the transparent ITO film with high transparency (> 80%) exhibits a low sheet resistance ranged from 400 to 20 ohm/Sq as the increase with annealing temperature as shown in figs. (b) and (c). As the result, the ITO thin films with high transparency and low sheet resistance were sucessfully fabricated onto glass substrates, and it can be a good candidate for using in optoelectronic devices due to its higher transmittance in the visible region and with good electrical properties [3, 4, 5].

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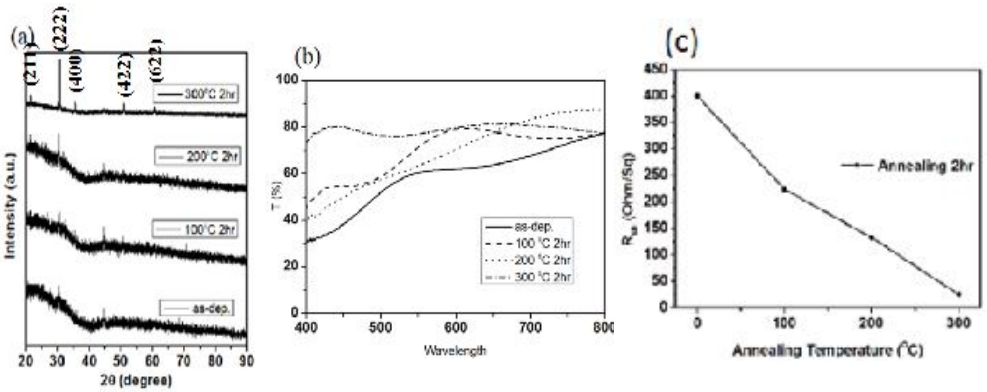

Figs. (a) XRD patterns for the ITO thin film before and after annealed in air at different temperatures for 2 hrs, (b) the transmittance of ITO thin films with different annealed temperatures in the wavelength range from 400 to 800 nm, (c) sheet resistance of ITO thin film after annealling with different temperatures for 2 hrs.