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Effect of Ti doping on Structural, Optical and electrical properties of SnO2 transparent conducting thin films deposited by sol-gel spin coating

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Abstract

In the present work, various concentrations of Ti (1, 2, 3, 4 and 5 at %) doped SnO_2 thin films were grown onto glass substrate using cost effective sol-gel spin coating method and subsequently investigated the effect of Ti doping concentration on structural, optical and electrical properties. X-ray diffraction studies revealed that all deposited films exhibit polycrystalline tetragonal rutile structure with fundamental orientation peak along (110) direction. Moreover, Ti doped SnO_2 films were started growing along (211) direction and it was more pronounced with increasing of Ti concentration. The average grain size was decreased with the increase of Ti concentration, confirmed by XRD and AFM studies. The UV–visible spectrometer measurements shown that the average transmittance of un-doped SnO_2 film was above 85%, whereas Ti doped SnO_2 films were found to be a decrease of transmittance up to 77% in 5 at% Ti:SnO_2 film. The optical band gap energy values were considerably decreased from 3.91 to 3.73 eV with increase of Ti content. Further, the sheet resistance (R_{sh}) and resistivity (ρ) values were found to be decreased with the increase of Ti doping up to 3 at % then it was slightly increased in 4 and 5 at % of Ti:SnO_2 films. The efficiency parameter figure of merit (φ) was also estimated for all deposited films with the function of Ti doping.

Keywords:

Spin coating, Transparent conducting oxides, Optical transmittance, Band gap energy, Figure of merit

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