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Effect of Heat Treatment on Structural and FTIR and Lowercase

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Introduction

Tin oxide (SnO_2) is an important oxide semiconductor with wide band gap (Eg=3.6 eV) exhibiting high transparency and high electrical conductivity. These characteristics make it a highly conductivity multifunctional material. Due to this, tin oxide thin films have been widely used in different application areas such us gas sensors, catalysis transparent electrode, Solar cells, spintronics and others. The most important use of SnO2 isfor gas sensors. The sensing properties of SnO2 sensors depend on several factors, mainly crystallite size, surface structure and existing bonds. Several methods have been employed for preparing tin oxide thin films including CVD, Sol Gel, spray pyrolysis and others.
In this paper we report on the preparation and structural characterization of tin oxide. We report the effect of the heat treatment temperature on cristalinity and FTIR spectra.

Experimental

SnO2 thin films have been prepared using Atmospheric Air Chemical Vapor Deposition (APCVD), tin Chloride $SnCl_2$ was employed as precursor. Thin films were deposited on glass substrate. We have used a three temperature zones horizontal tubular furnace which is attached to two separate gas sources, one for oxygen and the other for argon. The heat treatment was carried out in the same furnace. Samples were annealed for 30 minutes for 200°C and 400°C temperature.The X-ray diffraction patterns were collected using X'Pert Pro MPD of Panalytical. The FTIR spectra were drawn with an Alpha–Bruker spectrophotometer.

Results and Discussion

The XRD patterns recorded for all SnO2 samples showed the presence of tetragonal rutile-type structure (JCPDS N°: 041-1445). However, the unheated pattern shows only three broad peaks corresponding to the more Intense reflexions given a calculated crystallite size of 31,72 nm however, the weak crystalinity of unheated SnO2 thin filmhave not been observed in heated samples it has been modified. Both intensity and number of peaks have been increased show that the cristalinity of samples have been improved and the crystallite size becomes 39.2 and 39.8 nm respectively for heating samles . The Scherer relation estimate the average crystallite size of the samples. Moreover, the cell parameters (*a* and *c*) of the films extracted from the relation relevant for tetragonal structure.

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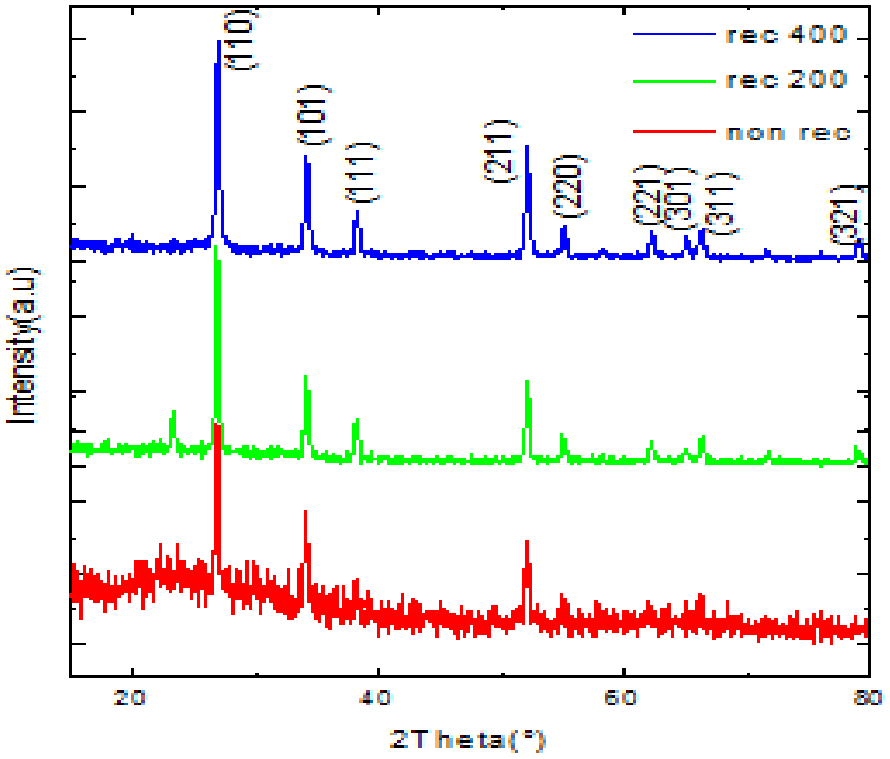

Figure 1: XRD patterns of SnO2 thin films. Unheated sample (red) heated 200°C (green), 400°C (bleu).

Figure 2 shows the FTIR spectra of the samples treated under the same annealing tempratures. The absorption peaks positions demonstrated that the SnO2 samples had the same chemical bonding characteristics.

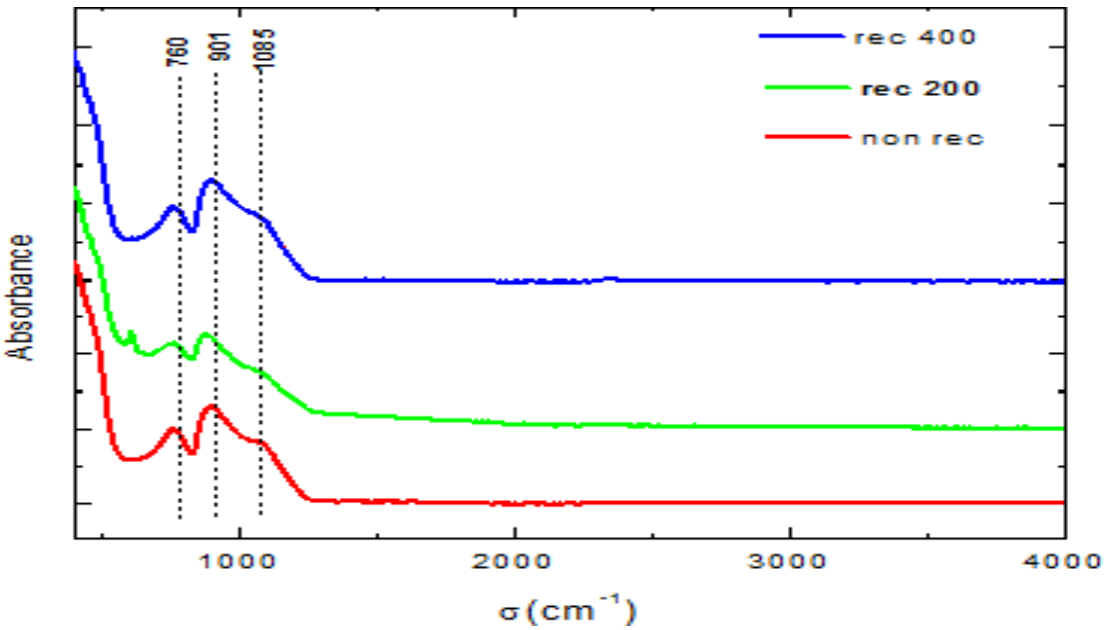

Figure 2: FTIR spectra of SnO2 thin films. Unheated sample (red) heated 200°C (green) and 400°C (bleu)

in the range of 700-970 cm^{-1} are due to the vibration of the oxygen bonds of the surface cations Sn=O and Sn-O. peak observed at about 1085 cm^{-1} was due to Sn–OHThere is not any peaks assigned to the carboxyl groups.

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Conclusion

The results show that the obtained layers correspond tothe rutile SnO2 structure of poly crystalline nature ofpreferential orientation according to the plane (110) which was confirmed by the literature. Both, line width and pic intensity depends on the annealing temperature. FTIR results confirm the XRD ones.

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