DOI: 10.1017/S1431927603441834
Microsc Microanal 9(Suppl 2), 2003


# MICROSTRUCTURAL STUDY OF TITANIUM DOPED TIN OXIDE FILMS DEPOSITED BY SPRAY PYROLYSIS

S. Romo-Aguilar[1], E. Torres[1], F. Paraguay-Delgado[1], and M. Miki-Yoshida[1,2]

(1) División de Física y Química de Materiales, Centro de Investigación de Materiales Avanzados, Miguel de Cervantes 120, Chihuahua, Chih., CP 31109, México
(2) Texas Materials Institute, University of Texas at Austin, Austin, Texas, 78712, USA.

Tin oxide films ($SnO_2$) have been employed broadly on diverse processes one of these is the manufacture of gas sensors, its electrical resistivity change when it is in contact with gas, and this change is a signal response.

But we can obtain better response when we incorporate doped or compounds like platinum, silver or other oxides. In this work we report the preparation and microstructural characterization of titanium tin oxide films obtained by spray pyrolisis technique 1, 2. The started solution was 0.05 M dilution of tin chloride in methanol and acetilacetonate of titanil were used as a source of titanium. The doped ratio was 1, 3, 5, 10, 20, 30, 40 and 50 % at. in solution Ti/Sn. The deposition temperature was 775 K.

Film thickness was obtained by reflectance measurement in F-20 fibber optic based system. Thickness varies as a function of doped percentage parameters between 230 to 360 nm. Transmission electron microscopy (TEM) analysis was used to evaluate the crystalline structure and grain morphology of the films. It is show in fig. 1 TEM bright field images of tin oxide doped by titanium were polycrystalline and that their structure corresponded to the tetragonal Cassiterite system, grain size change from 20 to 150 nm from low to higer percentage doped respectively. Morphology were analyzed by scanning electron microscopy, it is shown that crystalline agglomerate in round and square shaped grains. To get the composition (Ti/Sn ratio) and film stoichiometry (Sn/O ratio) we have analyzed the films by X-ray energy dispersive spectrometer (EDS) DX-4 ands by Digi-PEELS 766, fig 2 show EELS spectra in the film increase systematically to film like as in solution, we can see the tin and oxygen peak don't change.

These results support the viability of the spray pyrolisis technique to obtain titanium doped of tin oxide films, conglomerate of grains and grain size change as a function of doped percentage.

## References

1 M.Miki-Yoshida, E.Andrade, Thin Solid Films, 224 (1993) 87-96.
2 F. Paraguay D., W. Estrada L., D. R. Acosta N., E. Andrade, M. Miki-Yoshida. Thin Solid Films 350 (1999) 192-202

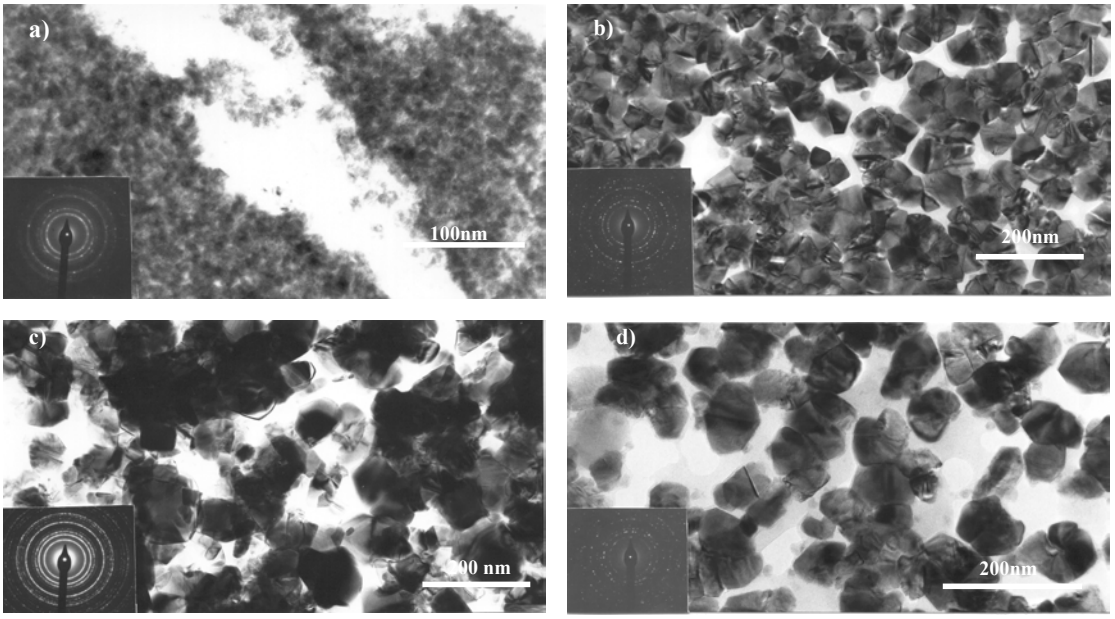


Fig. 1.- Bright field TEM micrographs of doped $SnO_2$ films deposited onto glass as a function of dopant contents in solution. a)1%, b)3%, c)5% y d)20% at. % Ti/Zn..

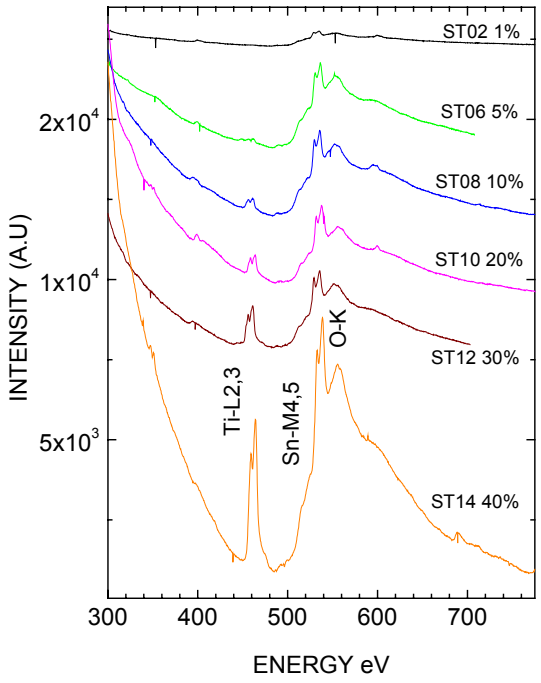


Fig. 2. Comparison EELS spectra of inner shell spectra recorded for different dopant contents.

https://doi.org/10.1017/S1431927603441834 Published online by Cambridge University Press