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MODELING OF ITO THIN FILMS UNDER ETCHING PROCESS BY USING X-RAY REFLECTIVITY

Calligaris, G. A.1,*; Mammana, S. S.2; Greatti, A.2; Luiz, F. H.2; da Costa, F. I.2; Mammana, A.P.2; Mammana, C. I. Z.2; den Engelsen, D.2; Cardoso, L. P.1

[1]*Institute of Physics Gleb Wataghin, UNICAMP, Campinas, SP, Brazil*

[2]*Associação Brasileira de Informática, ABINFO, Campinas, SP, Brazil*

gcall@ifi.unicamp.br

High electrical conductivity together with optical transparency of indium tin oxide (ITO) thin films make them mostly used for several electronics applications, such as displays and touch screens. ITO thin films made by lithography, with one etching step under wet conditions, is less expensive in comparison to laser ablation or plasma etching. Furthermore, along the recent years, smaller built-in ITO-coated devices requires a realiable way to examine the film quality. In this way, X-ray reflectivity (XRR) has enough sensitivity to provide information, such as thickness, roughness and density of a coated surface. In this work, the XRR technique is used to provide a better profile model for the ITO thin film during the wet etching process in oxalic acid at 60°C. XRR critical angle of the as-deposited 175 nm ITO film gives rise to a density of 6.986 g/ (expected value: 7.14 g/). After etching, a film morphology model that changes with etching time was obtained from the XRR pattern profile fit: for 25 min of etching time, three distinct layered-like density model was used, in contrast to two distinct densities for 35 min sample. XRR results shown that etching process provoked a huge reduction (175 down to 15 nm) in the total thickness as well as, several roughnesses (up to 7 nm). Through Scanning Electron Microscope and Energy Dispersive X-ray Spectroscopy one has observed well porous films, non-uniform clustered surface and also a selectivity character of the etching process that promotes SnO_2 cluster with respect to In_2O_3.