



Ceramics International 45 (2019) 8460–8470

<https://doi.org/10.1016/j.ceramint.2019.01.156>

Publication date : January 2019

### Morphological, surface and optical properties of spin-coated IrO<sub>x</sub> films; influence of spin speed, annealing and (Cr, La) codoping

Adel M. El Sayed, Mohamed Shaban\*

#### Abstract:

Iridium oxide (IrO<sub>x</sub>) is a fascinating metal oxide with superior chemical/physical properties. The present report is a try to tune the surface and optical properties of IrO<sub>x</sub> to widen its industrial and technological applications. The influences of substrates rotational speed (RS), annealing temperature (AT), Cr-doping, and (La, Cr) co-doping on the surface morphology and wettability, structural as well as the optical properties of spin-coated IrO<sub>x</sub> films are discussed. Raman spectra of the films show a characteristic phonon mode at 552 cm<sup>-1</sup>, arising from the Ir–O<sub>x</sub> stretching and influenced significantly by the preparative conditions (RS and AT) as well as Cr, La doping. EDX spectra were detected to confirm the chemical compositions of prepared IrO<sub>x</sub> nanostructure thin films. FE-SEM images reveal the growth of un-doped, Cr-doped and (Cr, La) co-doped nanorod-like IrO<sub>x</sub> structures. The annealed film at 500 °C and Cr-doped films showed the nanoporous nature of the grown nanorod-like structures. The films are hydrophilic and follow Wenzel Model. The wetting ability is enhanced by decreasing RS and increasing AT. Increasing RS result in increasing the transmittance (T%) owing to decreasing the films' thickness. At wavelength  $\lambda = 10^3$  nm, the deposited film shows T% = 53.2 and the film annealed at 500 °C exhibits T% = 44.3. The optical band gap ( $E_g^{op}$ ) increased with increasing RS and decreased with increasing AT. Cr-doping redshifted  $E_g^{op}$  from 2.95 to 2.85 eV, while, the co-doping with La blueshifted  $E_g^{op}$  to 3.14 eV. The effect of Cr and La doping on the optical constants of IrO<sub>x</sub> films was investigated and compared with those of other transition metal oxide films as no data are available in the literature for IrO<sub>x</sub> films.

<u>Adel M. El Sayed</u>	Designed the idea of the work, sample preparation, methodology, characterization, writing the original draft, reviewing and editing the final draft.
Mohamed Shaban	Contributed to work design, methodology, characterization, validation, contributed to writing, editing and reviewing the final draft.