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## Chemisorbed $CO_2$ on the Surface of Co-$SnO_2$, characterization and room temperature gas sensor

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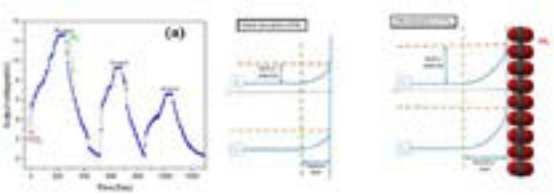
Pure and Cobalt doped Tin oxide ($SnO_2$ and $SnO_2$: Co) thin films of varying thickness were successfully fabricated by the sol-gel spin coating technique. The samples were characterized by X-ray diffraction (XRD) and scanning electron microscope (SEM). The effect of a number of layers on the structural and optical properties of $SnO_2$ and $SnO_2$:Co films was studied. The crystallite size of the pure $SnO_2$ films increased from 7.7 to 31.1 nm by increasing the number of layers from 12 to 24. The crystallinity of the film enhanced with increasing the annealing temperature from 400°C to 500°C. However, it reduced by incorporating Co atoms. The transmittance and the optical band gap of the $SnO_2$ film decreased by increasing the number of layers or after Co doping. The 8% Co-doped film shows relatively higher sensitivity for $CO_2$ gas at room temperature (RT) compared to un-doped $SnO_2$ film. The rate of increase of sensitivity with respect to $CO_2$ concentration is 0.116/sccm for Co-doped $SnO_2$. In this study, the carbon dioxide gas acted as an oxidizing agent that caused the increase in the electrical resistance of the sensor signified by the increase in voltage reading. Carbon dioxide sensing mechanism involves its disintegration into $CO^-$ and $O^-$. These species are adsorbed on the surface of the thin film. The negative charge trapped in these oxygen species caused an upward band bending on the $SnO_2$ nanomaterial thus increasing its resistance compared to the flat band situation before $CO_2$ gas exposure. The response and recovery times increased as the $CO_2$ concentration increased. The obtained results illustrate the possibility of controlling the film's physical properties for sensing and optoelectronic applications.



### Recent Publication

1. Mohamed A Basyooni, Ashour M Ahmed and Mohamed Shaban (2018) Plasmonic hybridization between two metallic nanorods. Optik Optik - International Journal for Light and Electron Optics DOI: 10.1016/j.ijleo.2018.07.135.
2. Mohamed A Basyooni, Mohamed Shaban and Adel M El Sayed (2017) Enhanced gas sensing properties of spin-coated Na-doped ZnO nanostructured films. Scientific Reports 7:41716.
3. Mohamed Shaban, G F Attia, Mohamed A Basyooni and Hany Hamdy (2015) Morphological and Structural Properties of spin coated Tin Oxide thin films. International Journal of Engineering and Advanced Research Technology 1(3):1-14.

4. Mohamed Shaban, Mohamed A Basyooni, G F Attia, Hany Hamdy () Synthesis and Characterization of Tin Oxide thin Films and Effect of annealing on Multilayer Film, The 5th international conference on modern Trends in Physics Research (MTPR-014), 15-19 December 2014, Cairo University, Egypt. The WPS International Conference Proceedings of the Fifth MTPR-014 Conference, Volume 9914, June 2015

## Biography

Mohamed A Basyooni has completed MSc degree in Experimental Physical Chemistry with honors at Nanophotonics and Applications Lab, Faculty of Science, Beni-Suef University in 2016. Now, he is a PhD research student at Department of Nano Science and Nano Engineering, Institute of Science and Technology, University of Konya Necmettin Erbakan-Turkey and Institute of Materials Research and Engineering (IMRE)-Singapore. He was working in semiconductor technology for many years to develop a room temperature gas sensors based on metal oxide semiconductors nanostructure thin films. He developed a room temperature gas sensor with more than 80% sensitivity towards carbon dioxide based on novel wrinkle porous net-work nanostructure-based sodium doped zinc oxide, published in Nature. Currently, he is working in energy efficient materials, vanadium dioxide ($VO_2$) based smart coatings and the gas sesnsing behavior.

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