

Title: Chemisorbed CO_2 on the Surface of Co-SnO_2, Characterization and Room Temperature Gas Sensor

Mohamed A. Basyooni [1,2,4*],Mohamed Shaban[3] and Gamal F. Attia[4]

[1]School of Materials Science and Engineering, Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798
[2]Department of Nano Science and Nano Engineering, Institute of Science and Technology, University of Konya Necmettin Erbakan, Konya 42060, Turkey
[3]Nanophotonics and Applications (NPA) Lab, Department of Physics, Faculty of Science, Beni-Suef University, Beni-Suef 62514, Egypt
[4]Space Research Lab, Solar and Space Research Department, National Research Institute of Astronomy and Geophysics (NRIAG), Helwan, Cairo, Egypt

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 ^oC to 500 ^oC. 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.

Biography

Mohamed A. Basyooni has completed M.Sc. degree in Experimental Physical Chemistry with honors at Nanophotonics and Applications Lab, Faculty of Science, Beni-Suef University in 2016. Now, he is a Ph.D. resaerch 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 works in energy efficient materials, vanadium dioxide (VO_2) based smart coatings and the gas sesnsing behavior.

Presenting author details

Full name: Mohamed Ali Basyooni
Contact number: +9 05393811857
Twitter account:
Linked In account: https://www.linkedin.com/feed/?trk=uno-reg-join-warm-sign-in
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