ACCEPTED ABSTRACT

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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 were studied. The crystallite size of the pure SnO_2 films increased from 7.7 to 31.1nm 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 of increase of 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 possibility of controlling the film's physical properties for sensing and optoelectronic applications.

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