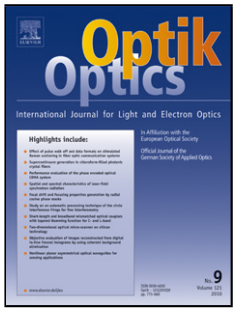

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HYDROGEN SULFIDE SENSOR BASED ON CUPRIC OXIDE THIN FILMS

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Abstract

In this work, thin films of copper oxide (CuO) doped with different concentration of samarium oxide (Sm_2O_3) have been prepared using spray pyrolysis technique with optimum temperature of 325˚C. Structural, optical and gas sensor behaviors of CuO:Sm_2O_3 nano films for Hydrogen sulfide (H_2S) gas were studied. XRD analysis of high dopant concentration, more than 5%, revealed a mixed phase of monoclinic and cubic symmetry of CuO and SmO structure respectively, with two most preferred orientations along (11-1) and (111) planes. Optical properties reveal high transparency in the range of visible region. Energy gap varied from 2.2 eV to 2.28 eV by increasing dopant concentration. Sensing results determined that, the best doping ratio with Sm_2O_3 was 3% to achieve fast response sensor.

Key words: *copper oxide; thin films; optical properties; H_2S gas.*

Introduction

Many researches were focused on air pollutant gases, such as H_2, CO, NO_2, CH_4, NH_3, C_3H_8, and H_2S, that contribute to the harm of human health, climate change and global warming [1]. The semiconductor gas sensors are being used on a large scale because of the low cost, easily manufacturing and high sensitivity as compared with the other sensor types like, optical, biochemical acoustic, and other gas-sensing devices [2]. The main reason for choosing semiconductor metal oxides as a gas sensor that it appears to change the electrical conductivity because of the reactions between gas molecules and the surface of semiconducting metal oxide, which make the Fermi level shifting either upward or downward within the band-gap [3]. However, the sensing device can not screening or gas measuring molecules of gas, but converting the signals into change in chemical or physical properties, e.g. :frequency, conductivity, temperature, pressure, color, or capacitance [1]. There are different methods used by researchers in preparation thin films of copper oxide. For example, Jamal M. Rzaij [4] have prepared nano films of CuO on silicon substrates by PLD (pulsed laser deposition) method with different energies (200-600)mJ of laser pulses.

A. Rydosz et al. [5] nano films of CuO doping with Si, Sb, Au, Ag, Pd, Pt, and Cr have been prepared using MST (magnetron sputtering technique) on ceramic substrates. A. Chapelle et al. [6] have been using a radiofrequency sputtering to prepare nano composite of CuO–$Cu_xFe_{3-x}O_4$. The effect of annealing on optical and structural