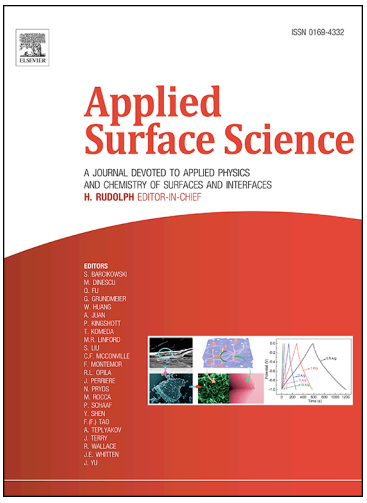

Full Length Article

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Tuning the morphology of Cr_2O_3:CuO (50:50) thin films by RF magnetron sputtering for room temperature sensing application

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ABSTRACT

In the present investigation, for the first time, we report the room temperature gas sensing characteristics of Cr_2O_3:CuO (50:50) thin films prepared by RF magnetron sputtering technique. The X-ray diffraction data show that the prepared Cr_2O_3:CuO (50:50) films are amorphous nature. The X-ray photoelectron spectroscopic study confirmed the formation of Cr^{3+} and Cu^{2+} states in the films. The growth conditions induce the change in morphology of Cr_2O_3:CuO (50:50) films from cauliflower like structure to single nanoplate like structure, which may be due to the change in nucleation. The FTIR spectra of Cr_2O_3:CuO (50:50) thin films exhibit peaks between 431 cm^{-1} and 774 cm^{-1} which correspond to the characteristic stretching vibrations of Cu-O and Cr-O bonds in the films. Optical study showed the RF power induced red shift in absorption edge, which revealed the systematic reduction in optical energy band gap of the films. The activation energy (ΔE) of Cr_2O_3:CuO (50:50) thin films estimated from the Arrhenius plot are varied between 0.369 and 0.504 eV. The respective response and recovery times of Cr_2O_3:CuO (50:50) thin film sensor exposed in 25 ppm of ammonia gas are about 11 and 14 s, while that in 100 ppm, are about 51 and 53 s. The maximum sensor response of 98% was observed for 100 ppm of NH_3 gas at room temperature. The present report suggests that the RF magnetron sputtered Cr_2O_3:CuO (50:50) thin films can perform efficiently as a ammonia gas sensor at room temperature.

Key words: Thin films, RF sputtering, mixed metal oxides, Cr_2O_3, CuO, room temperature gas sensor.

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