

Sputtered oxide thin films for gas sensing

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ABSTRACT

The preparation of oxide and/or nanocomposite thin films can lead to devices with attractive semiconducting properties. The majority of authors active in the field of oxide thin films, reports the elaboration of oxide thin films by reactive magnetron sputtering from a metallic target using an Ar-O₂ gas mixture. The proportion of oxygen present in the plasma then determines the stoichiometry of the oxide. However the control of this chemical reaction is quite difficult. Another method to obtain oxide thin films is by radio frequency (RF) sputtering of an oxide target. RF sputtering has many advantages like the possibility to obtain thin films with nanometric scale grain sizes and to control very easily the inter-granular porosity by varying the deposition parameters. These microstructural factors can enhance the sensitivity of the gas sensors.

Semiconductor nanocomposites with p-n junction have been reported in the literature as performing materials for gas sensing regarding operating temperature and response. Here thin layers (50 and 100 nm thick) were deposited by rf-sputtering from a CuFeO₂ target. P-type CuO and n-type CuFe₂O₄ bilayer was easily obtained after a thermal annealing in air of the as-deposited film at 450 °C for 12h. Interdigitated electrodes were patterned on the top of the annealed thin film via the sputter deposition of 100 nm thick gold through a metal shadow mask. The sensing response of CuO-CuFe₂O₄ semiconducting thin film was evaluated in four different gases (CO, H₂, NO₂, C₂H₅OH). The optimal temperature was found to be 250 °C.

We also show some other results on the use of WO₃ thin layers for CO₂ detection and the integration of sputtered NiFe₂O₄ layers onto micro-heaters processed by LAAS laboratory.

