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Alcohol vapor sensing by cadmium-doped zinc oxide thick films based chemical sensor

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Cadmium doped zinc oxide nanoparticles were derived by simple chemical co-precipitation route using zinc acetate dihydrate and cadmium acetate dehydrate as precursor materials. The thick films were casted from chemical co-precipitation route prepared nanoparticles by economic facile screen printing method. The structural, morphological, optical and electrical properties of the film were characterized relevant to alcohol vapor sensing application by powder XRD, SEM, UV-VIS and DC conductivity techniques. The response and sensitivity of alcohol (ethanol) vapor sensor are obtained from the recovery curves at optimum working temperature range from 20°C to 50°C. The result shows that maximum sensitivity of the sensor is observed at 25°C operating temperature. On varying alcohol vapor concentration, minor variation in resistance has been observed. The sensing mechanism of sensor has been described in terms of physical adsorption and chemical absorption of alcohol vapors on cadmium-doped zinc oxide film surface and inside film lattice network through weak hydrogen bonding, respectively.

Keywords: Doped zinc oxide; alcohol; sensor; thick films.

1. Introduction

Nanocrystalline transparent metal oxide semiconductors have drawn considerable attention of researchers due to their unique physical, chemical and optical properties. Zinc oxide (ZnO) belongs to the class of wide-bandgap semiconducting material ($E_g \sim 3.3$ eV) of n-type nature with hexagonal wurtzite structure and 60 meV binding energy and find practical applications in the field of sensors,[1–4] varistors, electro-optic[5,6] and microelectronic devices.[7–10] The stability of ZnO film has made it suitable alternative candidate to tin oxide and indium tin oxide films whose electrical and optical properties degrades in hydrogen plasma. Nowadays

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