GAS SENSING CAPABILITY OF SPRAY DEPOSITED Al-DOPED ZnO THIN FILMS

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Aluminium doped zinc oxide thin films were deposited from zinc acetylacetonate and aluminium acetylacetonate at various aluminium concentrations and deposition temperatures by ultrasonic spray pyrolysis. The structural and morphological properties and elemental composition of these films were studied by X-ray diffraction, scanning electron microscopy and energy dispersive X-ray spectroscopy, respectively. The gas sensing properties were studied by two point probe in 1%O_2/99%N_2 and 3% H_2/97%Ar at operating temperatures 60, 80, 100°C. The films are composed of hexagonal wurtzite type zinc oxide. The surface morphology of the films depends on the amount of aluminium doping. The hydrogen sensing capability of aluminium doped zinc oxide thin films deposited from 5 atomic percent Al/Zn solution decreases from 11% to 5.5% as deposition temperature is increased from 280°C to 400°C, but stability improves by an order of magnitude. The highest sensor response (8%) to 3 volume percent H_2 in Ar was observed at operating temperature 100°C in the film deposited at substrate temperature 400°C from the solution containing 2 atomic percent Al/Zn. Aluminium doping above 2 atomic percent Al/Zn in solution reduces film resistance by up to two orders of magnitude and sensor response decreases to 3% at 100°C. Response times as low as 3 seconds were observed when detecting hydrogen at operating temperatures 60-100°C.

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