Type of presentation: Poster

MS-3-P-3349 Structure of Ni doped ZnO thin films prepared by magnetron sputtering

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Zinc Oxide (ZnO) is of great interest for various photonic and electrical applications due to its unique physical and chemical properties. ZnO films doped with transition metals like Co, Mn, Ni, has been studied as a promising material for diluted magnetic semiconductors.

This work concentrate on structure of nickel doped ZnO films prepared by reactive magnetron sputtering. Thin films with nickel concentration 4.8, 5.3 and 8.4 wt% were prepared using BOC Edwards TF 600 coating system. Film thickness has been measured on cross-section and varies from 500 nm up to 670nm. X-ray diffraction (PANalytical) with Cu Kα radiation, scanning electron microscopy (JEOL JSM7600F), energy dispersive analysis using X-rays (Oxford Instruments) and high resolution transmission electron microscopy (JEOL JEM2200FS) has been used for thin film characterisation.

X-ray diffraction analysis reveals that the Ni was doped interstitially in Zn sites of ZnO without forming any detectable secondary phase. Preferred orientation is in [001] direction to the substrate surface for all three samples. The influence of Ni content on surface morphology of the films has been determined by field emission electron microscope. For lowest Ni content (4.8 wt%) grain size is not uniform and clusters of very fine grains are present with few large crystallites. Fig. 1 shows FE-SEM micrograph of the film with 5.3wt% of nickel with uniform grain size. Nickel content 8.4 wt% results in smaller grain size with homogenous distribution. Columnar structure with column width less than 100nm has been observed for all examined samples (Fig. 2). EDX map of nickel, zinc and oxide has been collected to analyse elemental distribution in thin films. EDX maps revealed homogenous distribution of nickel in all three samples. SAED profile of ZnO:Ni shows the structure [wurtzite] of pure ZnO monocrystals since the Ni doped interstitially in Zn sites. Cross-section on TEM shows ZnO monocrystals in columnar structure.

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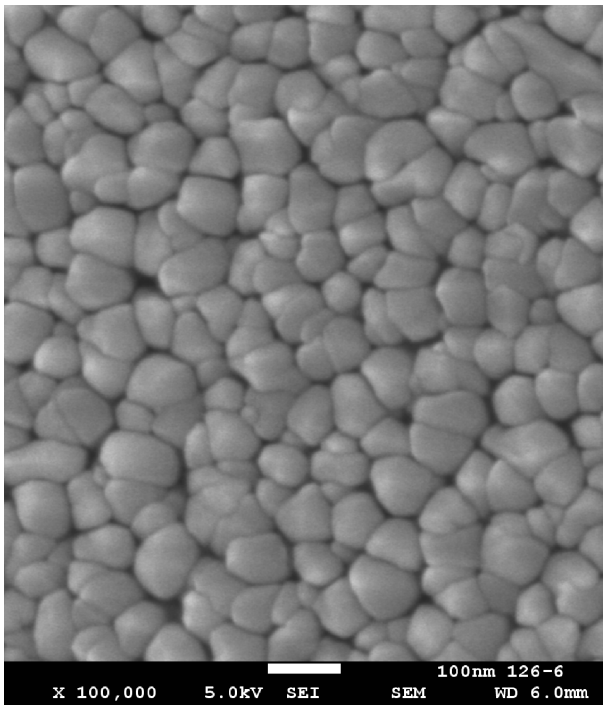

Fig. 1: As deposited surface, 5.3wt% Ni

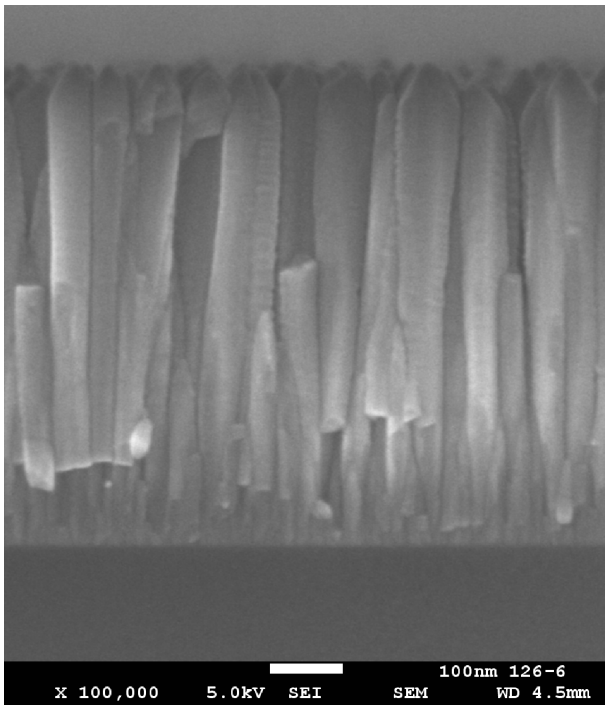

Fig. 2: Cross-section, 5.3wt% Ni

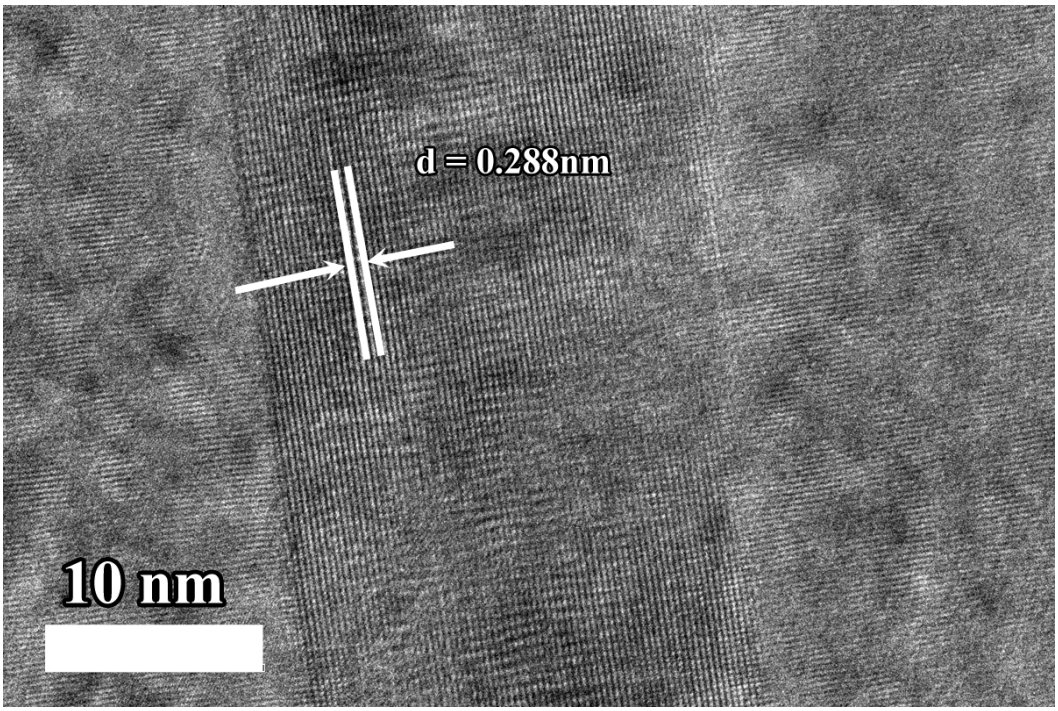

Fig. 3: HRTEM study of cross-section ZnO:Ni film