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Structural and optical properties of ZnO nanostructures grown byaerosol spray pyrolysis: Candidates for room temperature methaneand hydrogen gas sensing

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Abstract

We report on the synthesis of ZnO films by aerosol spray pyrolysis method at different deposition times.The surface morphology, crystal structure and the cross-sectional analysis of the prepared ZnO filmswere characterized by X-ray diffraction (XRD), focused ion beam scanning electron microscopy (FIB-SEM), atomic force microscopy (AFM) and high resolution transmission electron microscopy (HR-TEM).XRD analysis revealed that the ZnO films are polycrystalline in nature. Structural analysis exploitingcross-sectional TEM profile showed that the films composed of nano-particles and columnar structuresgrowing perpendicular to the substrate. AFM revealed that the columnar structures have a higher surfaceroughness as compared to the nanoparticles. The effect of ZnO crystallite size and crystallinity on the gassensing performance of hydrogen and methane gases was also evaluated. Sensing film based on ZnOnanoparticles has numerous advantages in terms of its reliability and high sensitivity. These sensingmaterials revealed an improved response to methane and hydrogen gases at room temperature due totheir high surface area, indicating their possible application as a gas sensor.