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Nanostructured ZnO: A promising material for sensing application

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Ultrasonic atomization technique was used to prepare nocrystalline ZnO powders. Effect of precursor concentration (0.1, 0.35, 0.5 and 0.75 M), pyrolysis temperature (973, 1073 and 1273 K) and aerosol carriers (Air/Oxygen) on ultrasonically atomized nanocrystalline ZnO powders was studied. The powders were characterized using X-ray diffraction, transmission electron microscopy, selective area electron diffraction, absorption spectroscopy and photoluminescence. It was observed from XRD and TEM that the powder consisted of nanocrystallites with sizes less than 20 nm. The nanocrystalline ZnO powder showed that crystallite sizes were observed to increase with an increase in the concentration of solution and pyrolysis temperature. The influence of air and oxygen on crystallite morphology was studied using TEM. It was confirmed from TEM analysis that the crystallites were nearly spherical in powder prepared in the presence of compressed air. In the presence of pure oxygen, the crystallites could acquire regular hexagonal shape. The effect of precursor concentration, pyrolysis temperature and aerosol carriers on crystallite size and morphology of nanocrystalline ZnO powders is reported in the present study. Furthermore this nanocrystalline ZnO powder is used to prepared thick films using screen-printing techniques. Thick film is used as sensor to test the conventional gas (LPG, Carbon dioxide, Hydrogen, Ammonia, Ethanol and Chlorine) and simulant (Dimethyl Methyl Phosponate, 2-chloroethyl phenyl sulfide and 2-chloroethyl ethyl sulfide of highly toxic chemical warfare agents (CWAs). The thick film sensor gives maximum response to Ammonia (conventional gas) and DMMP (simulant of CWAs).

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