

CHAPTER 4

CONCLUSIONS

4.1 Conclusions

Flame Spray Pyrolysis (FSP) was employed for the synthesis of pure ZnO and ZnO/MgO nanocomposites with different MgO doping levels ranging from 5-20 wt%MgO with controlled size and pure crystallinity in one step. Zinc naphthenate and magnesium acetate tetrahydrate were dissolved in ethanol and used as Zn and Mg precursors, respectively. In this work, nanoparticles were characterized by using X-ray diffraction (XRD), nitrogen adsorption (BET) analysis, scanning electron microscopy (SEM), energy-dispersive X-ray spectrometry (EDS) and transmission electron microscopy (TEM). XRD was used to confirm the phase and crystalline structure of nanoparticles. BET was a method of choice to evaluate the specific area of nanoparticles. SEM and EDS were employed to analyze the morphology and chemical compositions of nanoparticles. TEM was selected to determine the accurate size and morphology. The XRD patterns showed that the particles corresponding to hexagonal phase of ZnO and cubic phase of MgO. MgO peaks were found all ZnO/MgO nanocomposites. This fact indicated that the nanocomposites were not consisted of single phases but rather a composite. A trend of the specific surface areas (SSA_{BET}) of the samples increased while the diameter (d_{BET}) decrease with increasing MgO content (5-15 wt%MgO). The SEM micrographs show the nanospheres with an average diameter of 10-20 nm, and several nanospheres connected with each other. From this observation, it was found that the rough morphology and the rough particles size were not changed with the increasing MgO doping levels. The EDS elemental

mapping confirmed that MgO was actually in ZnO/MgO nanocomposites. The TEM bright-field images show the crystallite sizes of ZnO spheroidal and hexagonal particles were found to be in the range of 5-20 nm. ZnO nanorods were found to be approximately 5-15 nm in width and 15-30 nm in length. Also, the crystallite sizes of MgO spheroidal particles were found to be in the range of 5-10 nm. 5-20 wt% ZnO/MgO nanocomposites spheroidal particles were found to be in the range of 5-15 nm. 5 wt% and 10 wt% of ZnO/MgO nanocomposites were found to be approximately 5-10 nm in width and 10-20 nm in length.

4.2 Suggestion for future work

- 4.2.1 Preparation of pure ZnO and ZnO/MgO nanocomposites will be synthesized by other methods such as mechanical alloying and sol-gel method
- 4.2.2 ZnO nanoparticles can be composited with other metal oxide such as WO_3 or SnO_2 synthesized by flame spray pyrolysis.
- 4.2.3 Pure ZnO and ZnO/MgO nanocomposites will be investigated for anti-microbial activity, photocatalytic activity, optical properties and possibility for use as sensors.