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SYNTHESIS AND CHARACTERIZATION OF MgO NANOSTRUCTURES BY DIFFERENT SYNTHESIS METHODS

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AUTHOR'S DECLARATION

I declare that work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Magnesium oxide (MgO) is an interesting material and has unique properties which is applicable in many applications. In this research, novel MgO nanostructures of ultra-thin sheets were synthesized using three different synthesis methods which are solid-state reaction, sol-gel and combustion methods. The synthesis condition was optimized to obtain pure MgO compound. These pure samples were characterized using Simultaneous Thermogravimetric Analyzer (STA), X-Ray Diffraction (XRD), High Resolution Transmission Electron Microscopy (HRTEM) and UV-Vis spectroscopy. The results shows pure MgO nanostructures can be obtained at the temperature of 600 °C for all synthesis methods that gives the ultra-thin nanosheets as can be seen from high resolution TEM. Different synthesis methods can give surprisingly the same morphology but in different thicknesses. However, combustion method gives the thinnest nanosheets followed by the sol-gel and solid-state reaction methods. The band gap energy obtained for MgO samples synthesized by all methods have values of 5.825 eV to 5.955 eV which are much lower than the MgO bulk value of 7.8 eV. The characteristics of the band gap change with annealing time are different for the samples prepared by different preparation process. Therefore, the band gap energies of MgO nanostructures are sensitive to the different synthesis methods. Results show that the band gap energies of nanostructures can be tuned to a suitable value needed for various applications by controlling the annealing time. Sol-gel method is the best method for producing MgO nanostructures at a temperature of 600 °C and at the shortest possible time of 1 h and also capable of producing large amounts of final product compared to the other methods.

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