UNIVERSITI TEKNOLOGI MARA

PHYSICAL AND OPTICAL PROPERTIES OF SnO_2 QUANTUM DOTS PREPARED BY SOL-GEL METHOD

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results 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.

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ABSTRACT

Physical and optical properties are important characteristics of materials. Most metal oxide nanomaterials, such as, SnO_2 nanomaterials exhibit bandgap narrowing, however, SnO_2 quantum dots conversely exhibit band gap narrowing. It is important to understand this phenomenon at a more fundamental level. In this work, the reasons behind physical and optical properties is probed in terms of crystal structure, the role of surfactant and quantum mechanical effects of energy discretization in the materials. The samples were annealed at 350 ^oC and 450 ^oC for 1 h, 3 h, 5 h, and 24 h for the investigation of the different nanostructured SnO_2 quantum dots. The crystallite size of SnO_2 quantum dots using surfactant were found to decrease with calcination time. Crystal structural parameters were extracted via the Rietveld method and it was found that changes of both the a and c cell parameters were greatest in the crystallite size range of the nano region (100 nm and below). It was observed that there is a correlation between the crystallite size with the band gap of the nanomaterials. It is proposed that the band gap widening is due to the decrease in the hybridization of the SnO_2 quantum dots energy levels resulting in more discrete energy levels and the widening of the band gap. This quantum effect may not be seen in other metal oxides with different electronic configurations and crystal structure.

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