UNIVERSITI TEKNOLOGI MARA

STRUCTURAL AND PHOTOLUMINESCENCE PROPERTIES OF NANOSTRUCTURED ZINC OXIDE SYNTHESIZED BY IMMERSION METHOD

AZLINDA BINTI AB. AZIZ

Thesis submitted in fulfilment
of the requirements for the degree of
Master of Science

Faculty of Applied Sciences

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CONFIRMATION BY PANEL OF EXAMINERS

I certify that a Panel of Examiners has met on 14th August 2015 to conduct the final examination of Azlinda Binti Ab. Aziz on his Master of Science thesis entitled " Structural and Photoluminescence Properties of Nanostructured Zinc Oxide Synthesized by Immersion Method" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiners recommends that the student be awarded the relevant degree. The Panel of Examiners was as follows:

Khudzir Ismail, PhD
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Faculty of Applied Sciences
Universiti Teknologi MARA
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Umi Sarah Jais, PhD
Associate Professor
Faculty of Applied Sciences
Universiti Teknologi MARA
(Internal Examiner)

Shahrom Mahmud, PhD
Associate Professor
School of Physics
Universiti Sains Malaysia
(External Examiner)

SITI HALIJJAH SHARIFF, PhD
Associate Professor
Dean
Institute of Graduates Studies
Universiti Teknologi MARA
Date : 28th January, 2016

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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 result of my 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 other degree or qualification.

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Name of Student	:	Azlinda Binti Ab Aziz
Student ID No.	:	2010442922
Programme	:	Master of Science (AS780)
Faculty	:	Faculty of Applied Sciences
Thesis Title	:	Structural and Photoluminescence Properties of Nanostructured Zinc Oxide Synthesized by Immersion Method
Signature of Student	:	.....
Date	:	February 2016

ABSTRACT

In this present work, Zinc oxide (ZnO) nanostructures on gold-coated silicon (Si) substrate were prepared from zinc nitrate hexahydrate ($Zn(NO_3)_2.6HO$) and urea (CH_4N_2O) using a low-temperature solution-immersion method. High hierarchical structure of ZnO with high surface area were successfully synthesised by the immersion method through optimization of the reaction parameters, such as different substrate surface, alignment of substrate, concentration of precursor, ratio of stabiliser in solution, and different heat temperature. FESEM, EDX, XRD, AFM and PL were the selected characterization tools to analyse the morphological, structural, surface analysis and optical properties of ZnO nanostructures. FESEM images revealed that ZnO flowerlike microspheres consist of nanosheets was the dominant structure growth along synthesis parameter. The results give evidence that the smallest diameter ~11-13 μm of ZnO micro-flowers was successfully formed on gold-coated Si substrate, and gold served as a nucleation sites for the growth of ZnO micro-flowers. Low average surface roughness of ZnO nanostructures had shown the uniformity of particles size on gold-coated Si surface. The alignment of substrate tilt towards 60 ° was the better alignment towards smallest crystallite size 28.5 nm. PL emission spectra of ZnO nanostructures consistently produced UV (398-416 nm) and visible emissions (450-750 nm). UV peak corresponds to the ZnO nanostructures while peak at visible range relates to ZnO defects. PL results indicated that 0.40 M concentration of zinc nitrate and urea at 1:1 ratio had successfully formed ZnO micro-flowers consist of nanostructures with high intensity of UV emission, confirming high optical properties of the samples. At 500 °C of thermal treatment, ZnO nanostructures gave extremely high PL intensity which improved its optical property with better crystallization. Furthermore, additional analysis by PL temperature dependence of ZnO nanostructures sample had shown that the emission energies and intensities of the ZnO nanostructured strongly affected by the applied temperature. A plausible mechanism of the dissociation-deposition formation of micro-flower assembly of ZnO nanosheets from $Zn(NO_3)2$ and urea solution was also proposed.

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