



**UNIVERSITI PUTRA MALAYSIA**

**SYNTHESIS AND CHARACTERIZATION OF CDS /SiO<sub>2</sub>  
NANOCOMPOSITES**

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**SYNTHEESIS AND CHARACTERIZATION OF CDS /SiO<sub>2</sub>  
NANOCOMPOSITES**

**By**

**AESHAH NIZAR SALEM**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,  
in Fulfilment of the Requirements for the Degree of Master of Science**

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To my supervisor, my friends, my mother and my father who always had confidence  
and offered me encouragement and support in all my endeavours.

*May Allah save them all...*



Abstract of thesis presented to the Senate of University Putra Malaysia in partial fulfilment of the requirement for the degree of Master of Science

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**Supervisor: Professor Abdul Halim Shaari, PhD**

**Faculty : Science**

Core-shell nanocomposites are gaining lots of interest due to their potential application in different field like catalysis, sensor, electronic, biomedical ect. In addition, they show better properties when two different element nanoparticles coating each other than a single nanoparticles is used. In this thesis, we studied the synthesis Rout and characterization of CdS/PVA nanoparticles by hydrothermal method with different concentration of cadmium acetate deposited in a PVA matrix. SiO<sub>2</sub> nanoparticles by the sol-gel method with different concentrations of TEOS and CdS / SiO<sub>2</sub>core-shell nanocomposites by encapsulation Stober method. The result obtain by analysis of the product of CdS/PVA, SiO<sub>2</sub> and CdS / SiO<sub>2</sub>core-shell nanocomposites

have successful. The result of X-ray diffraction (XRD) analysis shows the cubic and hexagonal structure of the CdS nanoparticles, amorphous phase of SiO<sub>2</sub> and CdS/SiO<sub>2</sub> core-shell nanocomposites, The electrical properties including the d.c. conductivity of CdS/PVA were found to be  $2 \times 10^{-7}$  S/cm, and optical band gap



energy 2.53 eV respectively. To improve conductivity of SiO<sub>2</sub> nanoparticles when prepared CdS/SiO<sub>2</sub> nanocomposites were found to be  $6 \times 10^{-10}$  S/cm . The FTIR measurement absorption centred at 690 cm<sup>-1</sup> corresponding to the Cd–O. And at 1200 cm<sup>-1</sup> is assigned to Si-O group. However, The peak of PVA/CdS/SiO<sub>2</sub> particles was wider at about 3500 cm<sup>-1</sup>. The morphology of nanoparticles and nanocomposite study by (TEM) mentioned that the composites were estimated as being from 5-15 nm for CdS, 25- 140 nm for SiO<sub>2</sub>, and the CdS/SiO<sub>2</sub> was estimated to be around 15 nm for the core and above 30 nm for the shell.



Abstrak ini di kemukakan kepada Senat University Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

## **SINTESIS DAN PEMBENTUKAN CDS/SIO<sub>2</sub> NANOCOMPOSITES**

Oleh

**AESHAH NIZAR SALEM**

**November 2010**

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Teknologi pembentukan bahan kor teras komposit nano telah menarik minat banyak pihak memandangkan potensi produk yang luas didalam pelbagai bidang seperti katalisis, pengesan, elektronik, perubatan dan sebagainya. Tambahan pula, keupayaan bahan kor teras ini dapat dipertingkatkan apakala dua bahan kor teras di gabungkan melalui proses penyalutan. Dalam kajiselidik ini, manfa'at sintesis Rout dan penjelmaan partikel nano CdS/PVA melalui kaedah *hydrothermal* dengan pelbagai kelikatan Cadmium Acetate di baurkan di dalam matriks PVA yang tertentu di semak. Partikel nano SiO<sub>2</sub> diterbitkan mengguna pakai kaedah *sol-gel* dengan pelbagai kelikatan TEOS dan seterusnya kor teras CdS/SiO<sub>2</sub> dijana melalui kaedah penyalutan Stober. Hasil analisis keatas bahan komposit nano kor teras CdS/PVA, SiO<sub>2</sub> dan CdS/SiO<sub>2</sub> yang dizahirkan menunjukkan keputusan yang memberangsangkan. Analisis biasan X-ray (XRD) menunjukkan kerangka kubik dan hexagonal kor teras partikel nano CdS serta fasa amorphous SiO<sub>2</sub> dan CdS/SiO<sub>2</sub>. Ciri-ciri elektrik antara lain; konduktiviti arus terus CdS/PVA di ukur dengan

kejrituan  $2 \times 10^{-7}$  S/cm dan jalur tenaga optic pada 2.53 eV. Di dapati konduktiviti partikel nano SiO<sub>2</sub> bertambah baik dalam bentuk CdS/SiO<sub>2</sub>. Pengukuran serapan FTIR berpusat pada 690cm<sup>-1</sup> selaras dengan Cd-O dan pada 1200cm<sup>-1</sup> selaras dengan kumpulan Si-O. Walaubagaimanapun, kemuncak PVA/CdS/SiO<sub>2</sub> adalah pada kelebaran 3500cm<sup>-1</sup>. Morfologi partikel dan komposit nano yang dikaji melalui *Transition Electron Microscope* (TEM) menunjukkan ukuran antara 5-15nm untuk CdS, 25-140 nm untuk SiO<sub>2</sub> dan CdS/SiO<sub>2</sub> sekitar 15nm ukuran teras dan 30nm untuk litupannya.

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I certify that a Thesis Examination has met on to conduct the final examination of Aeshah Nizar Salem on her thesis entitled “Synthesise and characterization of CdS/SiO<sub>2</sub> nanocomposites in accordance with the Universities and University colleges Act 1971 and the Constitution of the University Putra Malaysia [P. U. (A) 106] 15 March 1998. The committee recommends that the student be awarded the name of relevant degree.

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## **DECLARATION**

I declare that the thesis is my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

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**Date:**

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