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Fabrication and characterization of zinc oxide and polythiophen thin films as hybrid solar cell / Nur Faridatul Ahmad Pauzi.

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PERPUSTAKAAN SULTAKAH NUR ZAHIRAH UMT

FABRICATION AND CHARACTERIZATION OF ZINC OXIDE AND  
POLYTHIOPHENE THIN FILMS AS  
HYBRID SOLAR CELL

By  
NUR FARIDATUL BINTI AHMAD PAUZI

A thesis submitted in partial fulfilment of the requirements for the award  
of the degree of Bachelor of an Applied Science (Physics, Electronics and  
Instrumentation)

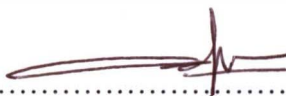
DEPARTMENT OF PHYSICAL SCIENCES  
FACULTY OF SCIENCE AND TECHNOLOGY  
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2010



**PENGAKUAN DAN PENGESAHAN LAPORAN PENYELIDIKAN SFZ 4399A/B**

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk Fabrication and Characterization of Zinc Oxide and Polythiophene thin films as Hybrid Solar Cells oleh Nur Faridatul binti Ahmad Pauzi, no. Matrik UK15440 telah diperiksa dan semua pembedaan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Fizik sebagai memenuhi sebahagian daripada keperluan memperoleh Ijazah Sarjana Muda Sains Gunaan (Fizik Elektronik & Instrumentasi), Fakulti Sains dan Teknologi, UMT.

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## DECLARATION

I hereby declare that this thesis entitles Fabrication and Characterization of Zinc Oxide and Polythiophene Thin Films as Hybrid Solar Cell is the result of my own research except as cited in the references.

Signature :  .....

Name : Nur Faridatul binti Ahmad Pauzi

Matrix No. : UK15440

Date : 16 April 2010

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## **FABRICATION AND CHARACTERIZATION OF ZINC OXIDE AND POLYTHIOPHENE THIN FILMS AS HYBRID SOLAR CELL**

### **ABSTRACT**

Hybrid solar cells are incorporating between inorganic semiconductors and organic semiconductors that potential to deliver efficient energy conversion with low-cost fabrication. The main aim is to integrate the benefits of both classes of materials. This research was focused on fabrication and characterization of zinc oxide (ZnO) and polythiophene (PT) thin films. The combination of ZnO and PT were according to the volume percentage of ZnO with 0.0%, 0.5%, 1.0%, 5.0%, 10% and 100% that coated onto indium tin oxide (ITO) glass via spin coating technique. Two types of ZnO were used in this study, one was synthesized by using zinc acetate dehydrate while the other one was the one that ready-made from Aldrich. The surface morphology of both types of particles was determined by using Scanning Electron Microscope (SEM). It showed that the morphology of synthesized ZnO was nearly the same with the one that ready-made even though the size was larger. ZnO + PT thin films were characterized to verify their electrical properties and optical properties. The measurement of electrical conductivity was carried out with the used of Four Point Probe in two situations, in the dark and also under different intensity of light. As a result, for all volume percentage of ZnO, the electrical conductivity increased as the intensity of light was increasing due to the combination with PT. However conductivity that obtained from synthesized ZnO was lower than ready-made due to the particles sizes. In favor of optical properties, the band gap energy was diminished as the thin film absorbs more light energy. It also showed that the size of particles gave significant in the research.

## **PENYEDIAAN DAN PENCIRIAN FILEM NIPIS ZINK OKSIDA DAN POLITHIOPHENA SEBAGAI SEL SOLAR KACUK**

### **ABSTRAK**

Sel solar kacuk adalah pengacukkan di antara semikonduktor bukan organik dan semikonduktor organik yang mempunyai potensi yang tinggi dalam menukarkan tenaga solar kepada elektrik tetapi menggunakan kos yang rendah dalam proses pembuatan. Kajian ini memfokuskan kepada penyediaan dan pencirian filem nipis zink oksida (ZnO) dan polithiophena (PT). Campuran antara ZnO dan PT adalah mengikut peratusan isipadu bagi ZnO iaitu 0.0%, 0.5%, 1.0%, 5.0%, 10.0% dan 100% yang dilapiskan di atas sisip kaca indium tin oksida (ITO) secara penyaduran berputar. Dua jenis ZnO yang digunakan di dalam kajian ini adalah satu yang disintesis sendiri menggunakan zink acetate dehidrat manakala satu lagi adalah ZnO yang telah siap dari Aldrich. Morfologi bagi permukaan partikel untuk kedua-dua jenis ZnO ditentukan menggunakan Microskop Elektron Pengimbas (SEM). Imej menunjukkan morfologi bagi sintesis ZnO adalah hampir sama dengan ZnO yang telah siap tetapi dengan saiz partikel yang lebih besar. Filem nipis ZnO + PT dicirikan untuk menentukan sifat elektrik dan optik. Pengukuran bagi menentukan kekonduksian elektrik adalah dengan menggunakan Penduga Empat Titik dalam dua keadaan iaitu satu apabila dalam keadaan gelap manakala satu lagi di bawah keamatan cahaya yang berbeza. Bagi setiap peratusan isipadu yang digunakan, kekonduksian elektrik meningkat dengan meningkatnya keamatan cahaya yang digunakan disebabkan oleh campuran PT dalam penghasilan filem nipis. Walaubagaimanapun, keputusan menunjukkan penggunaan ZnO yang disintesis mempunyai nilai kekonduksian yang lebih rendah. Manakala bagi sifat optik, jurang tenaga adalah semakin berkurangan apabila filem nipis dapat menyerap lebih banyak cahaya. Kajian ini turut menunjukkan kepentingan saiz partikel dalam mendapatkan keputusan yang baik.