

**THE PREPARATION AND CHARACTERIZATION OF ZnO THIN FILM DYE-
SENSITIZED SOLAR CELLS**


By
Wan Almaz Dhafina binti Che Wan Ahmad

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DEPARTMENT OF PHYSICAL SCIENCES
FACULTY OF SCIENCE AND TECHNOLOGY
UNIVERSITI MALAYSIA TERENGGANU
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DECLARATION

I hereby declare that this thesis entitled **The Preparation and Characterization of ZnO Thin Film Dye-Sensitized Solar Cells** is the result of my own research except as cited in the references.

Signature : 
Name : Wan Almaz Dhafina binti Che Wan Ahmad
Matrix No. : Uk 16309
Date : 14 March 2010



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oleh **WAN ALMAZ OHAFINA BT C.W. AHMAD**, no. matrik: **UK16309**

telah diperiksa dan semua pembetulan 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.

Disahkan oleh:

Penyelia Utama
 Nama: **ENGKU ABD GHAPUR BIN ENSKU ALI**
Pensyarah
 Cop Rasmi: **Jabatan Sains Fizik**
Fakulti Sains dan Teknologi
Universiti Malaysia Terengganu
21030 Kuala Terengganu

Tarikh: **27/4/2010**

Penyelia Bersama (jika ada)
 Nama:
 Cop Rasmi

Tarikh:

Ketua Jabatan Sains Fizik
 Nama: **DR. MOHD IKMAR NIZAM BIN MOHAMAD ISA**
Head
 Cop Rasmi: **Department of Physical Sciences**
Faculty of Science and Technology
University Malaysia Terengganu
21030 Kuala Terengganu

Tarikh: **3/5/10**

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ABSTRACT

The hydrothermal solution method is a one way that can make ZnO nanorods grow at low temperatures at low cost. The sample preparation is done through two stages. The first stage was seeding process where the ZnO nanoparticles are spin-casted on ITO glasses and the second stage was hydrothermal process. The morphology of nanorods were investigated by using scanning electron microscope (SEM) and diameters of nanorods are varied with different growth duration have been observed. The differences of diameters and aspect ratio of nanorods were affected the optical, electrical and the efficiency of the ZnO-coated thin film due to its surface area and electrons injection and transport speed. In this work, aspect ratio of ZnO nanorods increases with its growth duration that caused by the deposition over the deposited ZnO clusters increases by increasing the reaction time (growth time). From the band gap energy study, the thin film (sample C) with the longest ZnO nanorods growth time (6h) has the lowest band gap energy (3.55 eV). While band gap energy for sample B and A is 3.61 eV and 4.08 eV respectively. From the conductivity study, sample C owns the highest conductivity value followed by sample B and A. Therefore, sample C is the best thin film that can be applied in solar cells.

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ABSTRAK

Hydrothermal adalah salah satu kaedah untuk menghasilkan ZnO rod nano tumbuh pada suhu dan harga yang rendah. Sampel telah melalui dua peringkat, peringkat pertama adalah peringkat semaian dimana ZnO partikel nano disadur-putaran di atas slide kaca ITO dan peringkat kedua adalah proses hydrothermal. Morfologi rod nano dikaji dengan menggunakan mikroskop pengimbas electron, (SEM) dan diameter rod nano berubah-ubah disebabkan oleh masa pertumbuhan yang diperuntukkan adalah berbeza. Perbezaan diameter dan "aspect ratio" rod nano akan memberi kesan keatas sifat optikal, elektrik dan kecekapan ZnO filem nipis yang telah disadur disebabkan oleh nilai luas permukaan ZnO nanorod, injeksi dan kelajuan pergerakan elektron. Berdasarkan projek ini "aspect ratio" bagi ZnO rod nano bertambah dengan peningkatan masa pertumbuhan yang telah diperuntukkan. Ini disebabkan oleh semakin banyak kelompok ZnO yang termendap di atas kepingan kaca ITO dengan pertambahan masa pertumbuhan. Berdasarkan kajian tentang jurang tenaga filem nipis, filem nipis (sample C) yang mempunyai masa pertumbuhan ZnO rod nano yang paling lama (6h) mempunyai jurang tenaga yang paling rendah (3.55 eV) manakala jurang tenaga bagi sample B dan A ialah 3.61 eV dan 4.08 eV. Berdasarkan kajian kekonduksian filem nipis, sample C mempunyai nilai kekonduksian yang paling tinggi diikuti oleh sample B dan A. Oleh itu, sample C adalah filem nipis terbaik untuk diaplikasikan dalam solar sel.