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GRADIENT OF POINT OF VIEW

THESIS

AND FACULTY APPROVAL OF 1998

SCHOOL OF DISTANCE AND TECHNOLOGY
UNIVERSITY OF WASHINGTON, BERINGHAM

2018

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LP 16 FST 1 2010



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The effect of TiO2 particle to the conductivity of polythiophene thin film / Nur Farzana Amirah Ab Jamar.

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THE EFFECT OF TiO₂ PARTICLE TO THE CONDUCTIVITY OF
POLYTHIOPHENE THIN FILM

By
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A thesis submitted in partial fulfillment of the requirements for the award
of the degree of Bachelor Science (Physical Science)

DEPARTMENT OF PHYSICAL SCIENCES
FACULTY OF SCIENCE AND TECHNOLOGY
UNIVERSITI MALAYSIA TERENGGANU
2010



PENGAKUAN DAN PENGESAHAN LAPORAN PENYELIDIKAN SFZ 4399A/B

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk: THE EFFECT OF TiO₂ PARTICLE TO THE CONDUCTIVITY OF POLYTHIOPHENE THIN FILM

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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.

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DECLARATION

I hereby declare that this thesis entitled The Effect of TiO_2 particle to the Conductivity of Polythiophene Thin Film is the result of my own research except cited in references.

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ACKNOWLEDGEMENTS

Alhamdulillah to the almighty Allah (s.w.t) has given me the strength to finish my final year project successfully. Several people have been instrumental in allowing this project to be completed. I would like to thank my supervisor, Mr. Engku Abdul Ghapur bin Che Engku Ali for his help and advice from the beginning of this project. His generous support makes it possible for me to spend most of my time in this research. He has provided all of the benefits not only about research but also general life including inspiring me to do the original work.

I am deeply grateful to Madam paezah, Miss Suhaibah and all lab assistants, Mr Razman, Mr Zubairuddin, Mr Khairol Amilin, Madam Patheiyah, and Tuan Haji Asan with the help that are given in the lab. I also would like to thank to the staff at the Institute Oceanography for given me the opportunity to use the furnance and Scanning Electron Microscope (SEM) as part of the project.

I want to thank my labmates for the time we spent together. Especially, I want to thank my parents, sisters and brothers for their love, help, support, encouragement and financial support for me all of this time.

THE EFFECT OF TiO₂ PARTICLE TO THE CONDUCTIVITY OF POLYTHIOPHENE THIN FILM

ABSTRACT

This work focused on the study of electrical conductivity of titanium dioxide (TiO₂) and Polythiophene (PT) thin film on Indium Tin Oxide (ITO) substrate. The layered of TiO₂ and PT thin films with ratio 1:1, 1:5, 1:10, 5:1 and 10:1 was deposited on the ITO substrate by using spin coating technique. TiO₂ solution with 3 different pH (pH 2, pH 7 and pH 12) was prepared by using electrochemical method to produce TiO₂ particle. Structure and morphology of TiO₂ particle have been studied using X-Ray Diffraction (XRD) and Scanning Electron Microscope (SEM). The result shows TiO₂ particle showed like plain surface for TiO₂ particle with pH 2, while spherical particle were observed in TiO₂ particles with pH 7 and rod like particle obtained for TiO₂ particle with pH 12. From XRD, it shows that all of this TiO₂ particles exhibit anatase phase. TiO₂ particle with pH 12 was used as a layer on the thin film. The optical absorption of thin film was obtained from the UV-Vis spectrophotometer. The lowest energy gap is TiO₂:PT thin film at the ratio 5:1 which is 3.19eV. The electrical conductivity of the thin films was measured by using four point probes under dark and also under different light intensity (10, 30, 50, 80 and 100 Wm⁻²). Electrical conductivity under intensity of light shows that thin films with ratio 1:5 has the highest intensity of light that is 0.337Sm⁻¹.

MENKKAJI KESAN PARTIKEL TiO_2 KE ATAS KEKONDUKSIAN ELEKTRIK FILEM NIPIS LAPISAN POLITIOFENA

ABSTRAK

Fokus kajian ini adalah untuk mengkaji kekonduksian elektrik filem nipis lapisan poli-tiofena dan TiO_2 di atas substrat Indium Timah Oksida (ITO). Lapisan filem nipis poli-tiofena dan TiO_2 dengan nisbah 1:1, 1:5, 1:10, 5:1 dan 10:1 telah dimendapkan ke atas substrak ITO dengan menggunakan teknik penyaduran berputar. Larutan TiO_2 dihasilkan dalam 3 pH yang berlainan (pH 2, pH 7 dan pH 12) dengan menggunakan kaedah kimia untuk menghasilkan partikel TiO_2 . Struktur dan morfologi partikel TiO_2 dikaji dengan menggunakan pembelauan sinar X (X-ray diffraction) dan mikroskop pengimbas elektron (SEM). Keputusan menunjukkan partikel berbentuk rata terhasil dari larutan TiO_2 pH 2, manakala partikel berbentuk bulatan terhasil dari larutan TiO_2 pH 7 dan partikel berbentuk rod terhasil dari larutan TiO_2 pH 12. Dari XRD, keputusan menunjukkan kesemua partikel TiO_2 yang terhasil adalah dalam keadaan anatase. Partikel TiO_2 pH 12 digunakan sebagai lapisan di atas filem nipis. Kesan kadar penyerapan filem nipis didapati dengan menggunakan spektrofotometer UV. Jurang tenaga paling rendah bagi filem nipis lapisan TiO_2 :PT adalah pada nisbah lapisan 5:1 iaitu 3.19eV. Kekonduksian elektrik diukur dengan menggunakan kaedah penduga empat titik dalam keadaan gelap dan juga di bawah cahaya lampu dengan keamatan yang berbeza (10, 30, 50, 80 dan 100 Wm^{-2}). Kekonduksian elektrik di bawah keamatan cahaya mendapati filem nipis pada nisbah 5:1 mempunyai kekonduksian yang paling tinggi iaitu 0.337Sm^{-1} .