SURFACE MORPHOLOGY AND OPTICAL PROPERTIES OF COPPER NITRIDE THIN FILM SYNTHESIZED BY DC SPUTTERING

NURUL SHAHIDA BINTI MA'AJIH

UNIVERSITI TEKNOLOGI MALAYSIA
SURFACE MORPHOLOGY AND OPTICAL PROPERTIES OF COPPER NITRIDE THIN FILM SYNTHESIZED BY DC SPUTTERING

NURUL SHAHIDA BINTI MA’AJIH

A dissertation submitted in partial fulfillment of the requirement for the award of the degree of Master of Science (Physics)

Faculty of Science
Universiti Teknologi Malaysia

JUNE 2014
Specially dedicated to

*My beloved husband, En. Hanezan bin Hanaffi*

For supporting and encouraging me to believe in myself

*My parents, En. Ma’ajih bin Ismail and Pn. Narizan binti Mohd*

*My parents in law, En. Hanaffi bin Hj. Kesman and Pn. Azizah binti Hj. Muhamad*

A strong and gentle soul who taught me to trust in Allah, believe in hard work and that so much could be done with little

*My siblings from both families*

*Mohd Mustakim and Siti Nursabariah, Nurul Shahirah, Nurul Shahizzat*

*Fakhrul Nazhi and Farah Wahida, Farhan and Siti Suhana, Mohd Hanirulhaidi, Mohd Nurafendi, Rafidi, Rafidah*

For understanding and supporting me to achieve my dreams

and

*My lovely daughter, Nur Khairina Syafiqah binti Hanezan*

You are my strength
ACKNOWLEDGEMENT

All thanks to Allah SWT, who gave me opportunity and strength to complete this study.

First and foremost, I have to thank my parents for their love and support throughout my life. Thank you both for giving me strength to reach for the stars and chase my dreams. My beloved husband deserves my wholehearted thanks as well. My special thanks also dedicated to my sisters and brothers for their endless love, supporting and encouragement.

Then, I would like to express my deepest appreciation to my supervisor, Dr. Wan Nurulhuda binti Wan Shamsuri for her patience and tolerance in guiding, supporting and helping me throughout this project. A special thanks also goes to my Academic Coordinator (Physics), Assoc Prof Dr. Yusof Munajat whom have guided me in achieving the goal.

My sincere appreciation also extends to all laboratory staff members especially Mr. Keliwon Md. Saroji, Mr. Mohd Nazari Kamarudin, Mrs. Junaidah Saman and Mrs. Radiah Hassan for a lot of assistance provided on various occasions.

To all my friends, thank you for your understanding and encouragement in my many, many moments of crisis especially to Rosmaizatul Akma binti Sulaiman. Your friendship makes my life a wonderful experience.
ABSTRACT

The purpose of this research is to study the surface morphology and optical properties of copper nitride thin films. Copper nitride thin films were deposited on corning glass substrates by using DC sputtering technique. Five samples were prepared with five different deposition time to obtain samples of different thicknesses. Ellipsometer was used to measure thickness and refractive index. The surface morphology images were obtained by using Atomic Force Microscopy (AFM). Both transmission spectra and photoluminescence spectrum were obtained from UV-Vis-NIR spectrophotometer and Photoluminescence spectrometer, respectively. The films obtained were yellow to reddish-brown depending on increasing deposition time. The thickness of the samples increased as the deposition time increased. Thicknesses of films, \( d \) obtained were in range of 1092.38 nm to 1331.03 nm. Refractive index decreased as deposition times increased. The Atomic Force Microscopy images showed that the films were a smooth morphology and were seen like pyramidal islands when deposition time increased. Transparency of copper nitride thin film was very low in the visible region, but it slowly increased in the infrared range. The absorption coefficient, \( \alpha \) of copper nitride thin films increased with increasing of photon energy. The average optical band gap energy, \( E_g \) obtained in range of 1.56 eV to 2.06 eV. The best emission peak for maximum intensity was about 380 nm obtained in photoluminescence emission for all samples, which refer to ultra-violet light in visible light region of electromagnetic spectrum.
ABSTRAK