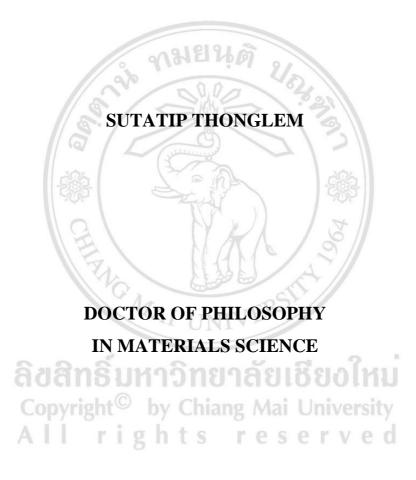
### FABRICATION OF TRANSPARENT CONDUCTING FILMS FOR SOLAR CELL APPLICATIONS



GRADUATE SCHOOL
CHIANG MAI UNIVERSITY
NOVEMBER 2014

### FABRICATION OF TRANSPARENT CONDUCTING FILMS FOR SOLAR CELL APPLICATIONS

SUTATIP THONGLEM

# A THESIS SUBMITTED TO CHIANG MAI UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN MATERIALS SCIENCE

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GRADUATE SCHOOL, CHIANG MAI UNIVERSITY
NOVEMBER 2014

## FABRICATION OF TRANSPARENT CONDUCTING FILMS FOR SOLAR CELL APPLICATIONS

#### SUTATIP THONGLEM

# THIS THESIS HAS BEEN APPROVED TO BE A PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN MATERIALS SCIENCE

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| (Asst. Prof. Dr. Sukum Eitssaveam)     |                                      |

19 November 2014 Copyright © by Chiang Mai University I dedicate my dissertation work to my family. A special feeling of gratitude to my loving parents, Rawat Thonglem and Chaweewan Thonglem for love and care. My sister, Suchada Thonglem, she has never left my side and are very special.

I also dedicate this dissertation to my advisor and co-advisor, Asst. Prof. Dr. Sukum Eitssayeam, Prof.Emeritus. Dr. Tawee Tunkasiri, Prof. Dr. Gobwute Rujijanagul, and Asst. Prof. Dr Kamonpan Pengpat for their guidance and support to my thesis. As I also dedicate this dissertation to my friends who have very supported me throughout my graduate study. I will always appreciate all technician have done, especially Duangpon Laksawat for kindness toward me, Pisan Moonrut for helping me develop my technology skills, and Denis Sweatman for proofreading my manuscript.

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Sutatip Thonglem

