EFFECT OF ANNEALING ON ENHANCING OPTICAL ABSORBANCE AND EMITTANCE PROPERTIES OF MAGNETRON-SPUTTERED TIN THIN FILMS FOR SOLAR THERMAL ABSORBER APPLICATIONS

By

Hanan Abd El-kader Abd El-Fattah Yousef

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
DOCTOR OF PHILOSOPHY
in
METALLURGICAL ENGINEERING

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Title of Thesis:

Effect of Annealing on Enhancing Optical Absorbance and Emittance Properties of Magnetron-sputtered TiN Thin Films for Solar Thermal Absorber Applications

Key Words:

Selective absorber; Optical properties; TiN; TiO_2; TiN_xO_y.

Summary:

The first part of this work covers the deposition parameters pf RF PVD sputtering technique and their effect of thin film properties. Second part covers a comparison between TiNxOy and TiN in as-deposited state and annealed state at 400 in air and in vacuum. In Third part TiN thin films are deposited at different times and flowrates of N2 gas then annealed at 800 in air and at 400 in air and in vacuum. Optical properties and microstructure of deposited TiN before and after annealing are studied. The change in optical properties after annealing are correlated to change in microstructure and structure of thin films. The optical properties of all thin films before and after annealing are characterized by spectrophotometer, and Fourier transform infrared spectroscopy (FTIR). The morphology and structure are studied by scanning electron microscope (SEM), atomic force microscope (AFM), X-ray diffraction (XRD), and Raman spectroscopy. It was found that the optical absorbance of sputtered TiN thin films is changed after annealing at 800°C and increased to 94% with a stable profile in ultraviolet (UV), visible range and near infrared (IR) ranges.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

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Acknowledgments

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Table of contents

List of Tables

LIST OF FIGURES