بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

MONA MAGHRABY

SELF CLEANING THIN FILM NANO-COATING FOR SOLAR PANEL GLASS

By

Mariam Ashraf Abu El-ezz

A Thesis Submitted to the
Faculty of Engineering at Cairo University
In Partial Fulfillment of the
Requirements for the Degree of

MASTER OF SCIENCE

In

Interdisciplinary M.Sc. - Advanced materials and Nano-materials

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2019

SELF CLEANING THIN FILM NANO-COATING FOR SOLAR PANEL GLASS

By

Mariam Ashraf Abu El-ezz

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of

MASTER OF SCIENCE

In

Interdisciplinary M.Sc. - Advanced materials and Nano-materials

Under the Supervision of

Prof. Dr. Nabil Mahmoud Abd El-Monem

Professor of Chemical Engineering,
Faculty of Engineering,
Cairo University

Prof. Dr. Ibrahim Mohamed Ahmed Ismail

Professor and director of Renewable Energy Engineering program
Zewail city of science and technology

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2019

SELF CLEANING THIN FILM NANO-COATING FOR SOLAR PANEL GLASS

By

Mariam Ashraf Abu El-ezz

A Thesis Submitted to the
Faculty of Engineering at Cairo University
In Partial Fulfillment of the
Requirements for the **Master of Science in**
Interdisciplinary M.Sc. - Advanced Materials and Nano-materials

Approved by the
Examining Committee

_____

Prof. Dr. Nabil Mahmoud Abd el-monem (Thesis main advisor)
Professor of Chemical Engineering، Faculty of Engineering, Cairo University

_____

Prof. Dr. Ibrahim Mohamed Ahmed Ismail (advisor)
Professor and director of Renewable Energy, Engineering program, Zewail city of science and technology

_____

Prof. Dr. Omer El Farouk Abd el-Salam (Internal examiner)
Professor of Chemical Engineering، Faculty of Engineering, Cairo University

_____

General Prof. Dr. Hosam El-sayed Mostafa (External examiner)
Assistant Director of the Military Technical College of Graduate Studies and Research

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2019

Engineer's Name: Mariam Ashraf Mohamed Qadry Abu El-ezz
Date of Birth: 5 / 7 /1989
Nationality: Egyptian
E-mail: Mariam.eng8899@gmail.com
Phone: 01118200272
Address: Giza

Registration Date: 1 / 10 / 2015
Awarding Date: …./…./2019
Degree: Master of Science
Department: Interdisciplinary M.Sc. – Advanced Materials and Nano-materials

Supervisors: Prof : Nabil Mohamed Abd el-moneim, Professor of Chemical Engineering, Faculty of Engineering, Cairo University

Prof :Ibrahim Ahmed Ismail, Professor of Chemical Engineering
Professor and director of Renewable Energy, Engineering program, Zewail city of science and technology

Examiners:

Prof. Dr. Nabil Mahmoud Abd el-moneim (Thesis main advisor)
Prof. Dr. Ibrahim Mohamed Ahmed Ismail (advisor)
Prof. Dr. Omer El Farouk Abd el-Salam (Internal examiner)
General. Prof. Dr. Hosam El Sayed Mostafa (External examiner)
Assistant Director of the Military Technical College of Graduate Studies and Research

Title of Thesis:

SELF CLEANING THIN FILM NANO-COATING FOR SOLAR PANEL GLASS

Key Words:

Nano-coating ; Thin film SiO2/TiO2 ; Super-hydrophilic; Self-cleaning ; Solar panel glass

Summary:

Researchers studied the effect of dust cleaning on Photovoltaic (PV) glass and its efficiency with time factor and the presence of dust on these PV panels leads to medium reduction yield up to 16% across the first-year. The aim is to investigate the application of self-cleaning by using different coatings such as titanium dioxide as thin film and silica pre-coated with titanium dioxide to improve the PV system and put alternatives using manual cleaning, with no lose in the effectiveness in maintenance yield. This achieves some of the goals of the 2030Agenda for sustainable development adopted by United Nation in 2015; throw this research we touch on the health and energy goals.

A set of experiments was done on laboratory scale by using the two coating layer and the results showed that using silica pre-coated with titanium dioxide on PV panels are more effective than using titanium dioxide layer only because of many reasons as there is no cracked layer, increasing in photo catalytic activity and also the stability of the coated layer is very high. And when measure these coating layer on a real PV panel with and without the coating we observed that the energy is improving and the coated panel can save energy up to 2.5%.

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.

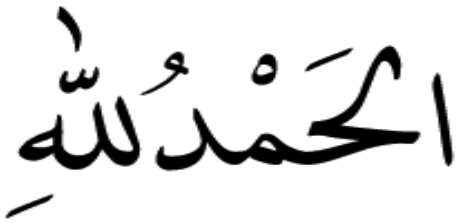
Name: Mariam Ashraf Abu el-ezz Date: 26/9/2019

Signature:

Dedication

I like to dedicate this thesis to my mother that I was hoping if she could share me this moment, and my newborn daughter Miriam I wish her to dream and keep trying to realize.

Acknowledgments



I would like to thank the main advisor Prof. Dr. Nabil Mahmoud Abd el-moneim of the chemical engineering Faculty at Cairo University . The door to Prof. Abdel-monem office was always open whenever I ran into a trouble spot or had a question about my research or writing. Also thanks the external advisor as the second reader of this thesis Prof. Ibrahim Ahmed Ismail, Director of the Renewable Energy Engineering Program, Zewail University of Science and Technology. He consistently allowed this paper to be my own work, but steered me in the right the direction whenever he thomught I needed it. Also I cannot forget to acknowledge the center of material science Zewail University of Science and Technology, under supervisor prof. Mohamed H.Alkordi Assistant professor Center of material science and I am fully grateful for his very valuable comments and advices on the experimental laboratory part of this work.

I would also like to thank the experts who were involved in the validation survey for this research project first, Prof. Dr. Omer El Farouk Abd el-Salam (Internal examiner) Professor of Chemical Engineering, Faculty of Engineering, Cairo University. secound, General .Prof . Dr. Hosam El-sayed Mostafa (External examiner) Assistant Director of the Military Technical College of Graduate Studies and Research. Without their passionate participation and input, the validation survey could not have been successfully conducted.

Finally, I must express my very profound gratitude to my great father. This accomplishment would not have been possible without him and to my husband for providing me with unfailing support and continuous encouragement throughout my years of study and through the process of researching and writing this thesis. Thank you.

Author
Mariam Abu El-ezz

Table of Contents

List of Tables