EFFECT OF ANNEALING TEMPERATURE ON TITANIUM DIOXIDE (TIO2) THIN FILM BY SOL-GEL METHOD

This thesis is presented in partial fulfilment for the award of the

Bachelor of Engineering (Hons) Electronic

Universiti Teknologi MARA

(JULY 2014)

ANGELINA VIVIANA ANAK HARRY (2010634352)
Faculty of Electrical Engineering
Universiti Teknologi MARA
40450 Shah Alam, Malaysia

ACKNOWLEDGEMENT

Praise the Lord for giving me such this wonderful opportunity to complete my electronic engineering project. Foremost, I would like to sincere gratitude to my supervisor, Dr. Puteri Sarah Mohammad Saad for the continuous support, encouragement and guidance throughout the progress of project. Her guidance helped me in all the time of my project research and writing of this thesis. I would like to thank my senior, Miss Irma Hidayanti for being such a supportive person to make this research project as a fun course to explore.

I would like to thank to the members of Nano-SciTech Laboratory (NST) and Nano-ElecTronic Centre (NET) especially Mr. Suhaimi, Mr.Daniel, Mr. Wan and Puan Nurul for the assistance and technical support in this project as well as simulating discussion.

Last but not least, my appreciation goes to my family as they always give me encouragement, finance and supports me all the years. Nevertheless, my great appreciation is given to my friend Hanis binti Sutan, Nurul Suhada binti Mat Rosli and those whom involve indirectly and directly with this project. Thank you very much.

Angelina Viviana Harry

Faculty of Electrical Engineering

Universiti Teknologi Mara (UiTM)

Shah Alam

Selangor.

ABSTRACT

Titanium dioxide (TiO_2) thin films were successfully deposited on glass substrates by sol-gel method and spin-coating technique with various annealing temperature. The thin films were annealed at 250°C, 350°C, 450°C and 550°C while as-deposited thin film was used as a reference sample. Electrical properties of TiO_2 thin films will be measured by using I-V measurement system It was found the resistivity of thin film at annealing temperature 450°C has the lowest resistivity ($6.7 \times 10^{-1} \Omega.m$) and optical spectra transmittance (94%). This will effects the value of conductivity of thin film which is 14.9×10^3 $(\Omega.m)^{-1}$. For optical properties, optical band gap and absorption coefficient were calculated using Tauc's plot and Lambert equation. While, surface morphology and roughness of thin films were characterized to determine using Atomic Force Microcopy (AFM) the structural properties of thin films. The optical band gap is in range between 3.90eV to 3.99eV. Thin film annealed at temperature at 450 °C shows low optical band gap (3.99eV) due to high roughness and good uniformity of surface morphology.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Organic solar cell (OSC) still in the early stages of development and nowadays, efficiency of conversion of sunlight is increasing due to the introduction and improving materials engineering in performances of OSC [1]. The large interest in OSC results from technological aspects as the expected ease of large-scale manufacturing at low-temperature processes and very low costs. In construction of thin film in OSC, nanostructured layer type is being considered as it shows high surface energy and good uniformity of surface. The advantages of using 'nano' in thin film is light generated electrons and holes travel path to penetrates into thin films is short and cause recombination losses reduced. Hence, the absorber layer thickness in nano-structured OSC can be as thin as 150 nm instead of several micrometers in traditional thin film solar cells. Other than that, by controlling the size of nano-structured in thin films, we also can control energy band gap of various layer in OSC. This allows for improvement in OSC in order to achieve optimum of photocatalytic activity [2].

Various nano-structured materials have been used to fabricate solar cells. Titanium dioxide (TiO_2) also known as titania, is one of n-type semiconductor oxides that can be used as thin film in OSC due to their desirable properties such as high