MEMRISTIVE BEHAVIOR OF TiO_2 THIN FILMS BY RF MAGNETRON SPUTTERING

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

Bachelor of Engineering (Hons) Electronic

Universiti Teknologi MARA

(JULY 2012)

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ACKNOWLEDGMENT

In the name of ALLAH S.W.T, the most Merciful and most Gracious

Firstly, I would like to thanks my research supervisor, Dr. Sukreen Hana Herman for her advices, encouragement and guidance throughout the research. My thesis would not been possible without her supervision. I also would like to express my sincere appreciation to Aznilinda Zainuddin for giving her time to share knowledge and support about this experiment. My special thanks also go to Universiti Teknologi MARA (UiTM) especially for the NANO – Electronic Centre (NET) and NANO - Science Centre (NST) technicians, Mr. Shahril, Mr. Suhaimi, Mr Daniel, Mr. Azwan and Mr. Azlan for their assistance in the lab. Finally I would like to express my deepest thanks to my family and friends for their love, encouragement, understanding, and support during my entire research period.

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July 2012

ABSTRACT

This project is on the fabrication and electrical characteristic of a memristive device with titanium dioxide (TiO_2) as an active layer on two different substrates which are silicon (Si) and glass. Bottom electrodes of 60nm thick platinum were grown on the substrates before the TiO_2 deposition. Two layers of TiO_2 thin films were grown on the bottom electrode by radio frequency (RF) magnetron sputtering forming a memristive device. The first set of sample is a layer of TiO_2 deposited on silicon substrate and exposed to plasma before the deposition of the second layer. The plasma treatment time was varied; for 0 minutes, 5 minutes and 10 minutes. The second set of sample is a TiO_2 layer deposited on glass substrates and being etched by 1% hydrofluoric (HF) before deposition the second layer. The etching time was varied; for 5 seconds and 7 seconds. Current–voltage (I-V) curves of the samples were taken from the voltage loop ranging 0V to -5V, -5V to 5V then back to 0V and also from -5V to 5V then back to -5V to show the bias dependent switching characteristics that match the electrical behavior reported for memristor. The second set of sample (etching method) gives better memristive behavior compared to the first set of sample (plasma treatment method). Beside, second loops which were measured from -5V to 5V then back to -5V, gives batter memristive behavior with less noise compared to the first loop.

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CHAPTER 1

INTRODUCTION

This chapter described us about the introduction to this project. There are five sections in this chapter. First section is elaborated about the background of study for this project. Section two is discussed about the problem statement for this project. The objective that related to the problem statement and this project was discussed in section three. The fourth section is explained about the scope of work for this project. Lastly, the organization of thesis described in the last section of this chapter five.

1.1 BACKGROUND OF STUDY

Titanium Dioxide (TiO_2) is well known as a metal oxide semiconductor and has been extensively studied in many applications. The Growth of research of TiO_2 as a useful semiconductor material has flashed interest among researchers to study this special compound. The advantages of TiO_2 are includes wide energy band gap (3.2 eV), non-toxicity, chemical inertness, high photocatalytic property and its' abundance in nature [1].

Because of their good in optical, electrical, structural properties and chemical and TiO_2 thin films have been extensively used for many applications such as photocatalyst, multilayer optical coating, and thin film devices for solar cell and also in sensor applications. Furthermore, due to high dielectric constant in TiO_2 thin films, there are used in the reaction process between the materials in many electronic applications [2]. Other than all application mention, memristive device is also another application that uses TiO_2 as its active layer. Memristor is generally made from a