PRECURSOR MOLARITY EFFECT ON THE MEMRISTIVE BEHAVIOUR OF SPIN COATED TITANIA THIN FILM

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

Bachelor of Engineering (Hons) Electronic

Universiti Teknologi MARA

(JANUARY 2014)

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ACKNOWLEDGEMENT

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

First and foremost, I would like to express my gratitude to ALLAH S.W.T Most Benevolent and Most Merciful who gave me the ideas and physical strength in preparing this thesis. I also would like to express my appreciation and acknowledgement to my supervisor Dr. Sukreen Hana Herman who has given me guidance and contribution of ideas in preparing this thesis. Also a special thanks for her constant encouragement, supervision and her creative suggestions. Without her motivation and assistance, I will not be able to complete the research and this thesis successfully. Besides, I also would like to express my sincere appreciation to Nur Syahirah Kamarozaman for sacrificing her time to share knowledge and support about this experiment especially during lab session. My special thanks also go to Universiti Teknologi MARA (UiTM) especially for the NANO – Electronic Centre (NET) and NANO - Science Centre (NST) technicians for their assistance in the lab and gave the permission to use all required equipment and the necessary materials throughout the research period. Finally, I would like to thank my beloved family especially my parents who never stop giving their love, encouragement, and full support in order for me to complete the entire research and I am also indebted to all my friends for their moral support during the entire research period.

Mohd Adib bin Mahmudin
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January 2014

ABSTRACT

This project is mainly about device fabrication which is titanium dioxide (TiO_2) memristor and characterized it for the electrical behaviour and physical characteristic. TiO_2 thin film is the active layer in between two different substrates which are the 60nm platinum (Pt) as the top electrode and ITO substrate as the bottom electrode in the vertical configuration. The TiO_2 thin film was deposited on the ITO substrate by sol-gel spin coating method. Prior to the deposition process, precursor molarity (Titanium (IV) isopropoxide) of the mixture of TiO_2 solution was varied to 0.05M, 0.1M, 0.2M, 0.3M, and 0.4M. After the deposition process of TiO_2 thin film, the sample was annealed for 20 minutes in the furnace with temperature of 250°C before the Pt deposited as the top electrode of the sample by using sputter coater. For the electrical characterization, current-voltge (I-V) measurement was carried out three times for each sample by considering positive voltage sweep to ensure the stable switching loop obtained. Besides, the physical characteristics of the sample that have been measured were the thickness, surface morphology, oxygen concentration and Raman measurement of the TiO_2 thin film. We found that the precursor molarity does not affect the memristive behaviour however, the sample with less precursor molarity is preferred due to lesser time is required to obtain the stable switching loop.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

The term ‘memristor’ is basically the simplified term of ‘memory resistor’ which indicates its function behavior which is, it's able to memorize the recent dynamic resistance even when the power is turned off. Memristor is known as a two-terminal device which the resistance depends on the magnitude and polarity of the voltage applied to it. The main idea of this device is simple which whenever the voltage turned off, this memristor able to remember the most recent resistance until the voltage turned back on. Memristor can be said as a great discovery in the semiconductor industry because it is a new element of analog circuit that works in computer architecture aside of resistor, transistor and capacitor [1].

Basically, there are three basic two terminal circuit elements were defined in terms of a relationship between two of the four fundamental circuit variables, which are the current I, the voltage v, the charge q, and the flux-linkage [2]. Basically, resistor, capacitor and inductor are the only well known fundamentals basic circuit elements which gave us three basic relationships. Those three are resistor relates with voltage and current ($dv=R.di$), capacitor relates between charge and voltage ($dq=C.dv$), and inductor relates with flux and current ($d\varphi = L.di$). Thus, there are missing link between the charge and magnetic flux [3]. As shown in Figure 1.1, the missing link between charge and magnetic flux were proposed by Dr Leon Chua and called as memristence, ($Mq = d\varphi/dq$)[3], [4].