FABRICATION AND MEMRISTIVE BEHAVIOR CHARACTERIZATION OF TITANIA THIN FILMS DEPOSITED BY REACTIVE SPUTTERING

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

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ABSTRACT

This project is on fabrication and memristive behavior characterization of titania thin films deposited by reactive sputtering titanium dioxide (TiO_2) thin films on ITO substrate. TiO_2 thin films were deposited on ITO substrate reactive sputteringmethod while varying theoxygen flow rate (O_2/ (O_2 + Ar) x100) from10, 20 to 30%. TiO_2 filmwith 40 nm thickness was deposited between Pt and ITO substrate to form a metal-insulator-metal (MIM) structure, which is the fundamental structure of a memristive device. Current voltage measurements (I-V) of the samples were taken within the range of -5 V and 5 V. The electroforming of theI-V measurement was doneby applying positive bias from 0V to 10V. It was found that the memristive behavior was less noisy after the electroforming process compared to before the electroforming and the sample deposited with 20% oxygen flow rate gave the best memristive behavior.

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CHAPTER 1

INTRODUCTION

In 1971, Leon Chua theorized the existence of what was believed to be the fourth fundamental passive circuit element, memristor. Memristor is an element that has the relation between charge and flux (dφ=Mdq)[1] and this relation is evidently missing from the basic fundamental circuit element which contains the resistor, capacitor, and inductor.

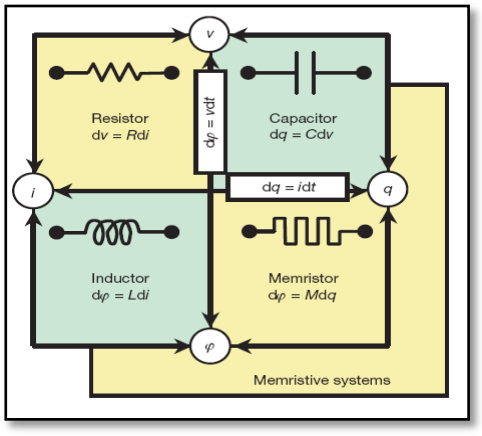

Figure 1: The four fundamental two-terminal circuit elements [1]

Figure 1 above shows that the resistor relates voltage and current (dv=R.di), capacitor relates charge and voltage (dq=C.dv), and inductor relates flux and current (dφ=L.di), thus the relation between charge and flux proposed to be a memristor[3]. The memristor completes the four fundamental passive circuit elements. Stanley Williams and team at Hewlett-Packard Laboratories (HP Lab) in 2008 have experimented the first memristor[3] and was successfully found and structured in their