UNIVERSITI TEKNOLOGI MARA

FUNDAMENTAL MEMRISTIVE BEHAVIOUR STUDIES OF SPUTTERED AND SOL-GEL DERIVED TITANIA THIN FILMS

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

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ABSTRACT

The thesis presents the fundamental memristive behaviour studies of sputtered and sol-gel derived titania thin films. The current fabrication methods are limited to the expensive and multiple fabrication steps to fabricate the device. Thus, in this work, simpler and low cost methods are studied using sol-gel spin-coating and sputtering method. A one layer of titania thin film was deposited sandwiched between Pt and ITO substrate to form metal-insulator-metal structure (MIM) which is the fundamental structure of memristive device. The fabrication methods can be divided into four fabrication methods including the spin-coating method, sputtering followed by annealing method, sputtering followed by immersion method and lastly the reactive sputtering method. The memristive behaviour and its physical properties including the film thickness, surface morphology, cross-section and crystallinity of the samples were studied. The result suggested that the film thickness mainly affects the switching behaviour instead of the crystalline structure of the films. Based on the I-V characteristics, the sample deposited by reactive sputtering method while varying the oxygen flow rate during deposition process gave better switching behaviour due to their higher resistance ratio compared to other methods. The issues on the characterization of memristive behaviour were studied including the effect of electroforming process, measurement cycles and different direction of bias voltage. The electroforming process and measurement cycles improved the switching behaviour by creating the path for the ion movement within the active layer. Relating the I-V characteristics of the samples, the model of the oxygen vacancies movement in the active layer was proposed.

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CHAPTER THREE : METHODOLOGY