UNIVERSITI TEKNOLOGI MARA

METAL OXIDES-BASED MEMRISTIVE DEVICES: FABRICATION AND CHARACTERIZATIONS

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Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Electrical Engineering

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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 results of my own 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 degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

This thesis presents the metal oxide-based memristive device intended for sensor application. Sol-gel spincoating technique was proposed as a simple method to fabricate the TiO_2-based and ZnO-based memristive devices. These devices were compared for their performances by investigating their properties characterization. Lateral configuration memristive device was also proposed to investigate its capability of resistive switching. Both vertical and lateral configurations of memristive devices were discussed. Spin coating speed, annealing time and temperature were varied for vertical configuration memristive devices. Meanwhile, oxide width and electrodes width are varied for lateral configuration memristive devices. Samples produced were characterized for its resistive switching and supported by their physical properties characteristics. It was found that ZnO-based and TiO_2-based memristive devices with spincoating speed of 3000 rpm, annealed 350 °C for 1 hour are the optimized samples with resistance ratios of 1.96 and 3.233 respectively. Meanwhile, for the lateral configuration of TiO_2-based memristive device with oxide width of 0.1cm and electrodes width of 1cm is the optimized sample. Sensing capability of these metal-oxides memristive devices were also investigated and it was proven that TiO_2 is suitable for UV sensor application as opposed to ZnO. Electroforming process was carried out to determine the suitable voltage sweep for metal oxides in order to avoid irreversible damage to the samples. Measurement cycles were carried out to observe the memristive devices' reproducibility. The effect of polarity of voltage was also explored to observe the switching capability of the memristive device under different polarity bias application.

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