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Incorporation of Copper for Performance Enhancement in Metal-Oxides Resistive Switching Device and Its Potential Electronic Application

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Abstract : In this work, the fabrication and characterization of copper-doped zinc oxide (Cu:ZnO) based memristor devices with aluminum (Al) and indium tin oxide (ITO) metal electrodes are reported. The thin films of Cu:ZnO was synthesized using low-cost and low-temperature chemical process. The Cu:ZnO was then deposited onto ITO bottom electrodes using spin-coater technique, whereas the top electrode Al was deposited utilizing physical vapor evaporation technique. Ellipsometer was employed in order to measure the Cu:ZnO thickness and it was found to be 50 nm. Several surface and materials characterization techniques were used to study the thin-film properties of Cu:ZnO. To ascertain the efficacy of Cu:ZnO for memristor applications, electrical characterizations such as current-voltage (I-V), data retention and endurance were obtained, all being the critical parameters for next-generation memory. The I-V characteristic exhibits switching behavior with asymmetrical hysteresis loops. This work imputes the resistance switching to the positional drift of oxygen vacancies associated with respect to the Al/Cu:ZnO junction. Further, a non-linear curve fitting regression techniques were utilized to determine the equivalent circuit for the fabricated Cu:ZnO memristors. Efforts were also devoted in order to establish its potentiality for different electronic applications.

Keywords : copper doped, metal-oxides, oxygen vacancies, resistive switching
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