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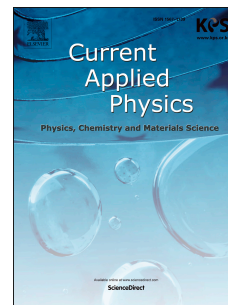
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Elimination of endurance degradation by oxygen annealing in bilayer

ZnO/CeO_{2-x} thin films for nonvolatile resistive memory

Muhammad Ismail¹, Shazia Jabeen², Tahira Akber², Ijaz Talib², Fayyaz Hussain², Anwar Manzoor Rana², Muhammad Hussain³, Khalid Mehmood⁴, Ejaz Ahmed² and Dinghua Bao^{1*}

¹ State Key Laboratory of Optoelectronic Materials and Technologies, School of Materials Science and Engineering, Sun Yat-Sen University, Guangzhou 510275, China

² Department of Physics, Bahauddin Zakariya University, Multan-60800, Pakistan

³ Department of Physics, University of Okara, Okara-56300, Pakistan

⁴ Institute of Chemical Sciences, Bahauddin Zakariya University, Multan-60800, Pakistan

Abstract

Effect of oxygen annealing on bipolar resistive switching (BRS) properties of TiN/ZnO/CeO_{2-x}/Pt devices was investigated. Bilayer ZnO/CeO_{2-x} thin films were fabricated by rf-magnetron sputtering. It was observed that the improvement in cycle-to-cycle endurance degradation and uniformity of the bilayer ZnO/CeO_{2-x} thin film is optimum at 400 °C annealing temperature due to decrease in oxygen vacancies during annealing, as confirmed by x-ray photoelectron spectroscopy. The BRS could be caused by the formation of interfacial TiON layer, which is most likely to be accountable for creating an adequate quantity of oxygen vacancies necessary for the formation and rupture of conductive filaments. Smaller Gibbs free energy of the formation of interfacial TiON (-611 kJmol^{-1}) layer as compared to bilayer film ZnO (-650 kJmol^{-1}) and CeO₂ (-1024 kJmol^{-1}) results in an easier re-oxidation of the filaments through the oxygen exchange with TiN top electrode. The analysis of current-voltage characteristics shows that the charge transport mechanism is Schottky emission. Moreover, the temperature dependence of high resistance state (HRS) and low resistance state (LRS) revealed

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