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Resistive switching characteristics of 11nm-thick metal oxide thin film for nonvolatile memory applications

Berhanu Tulu[1,2], W Z Chang[1], J P Chu[1]* and **S F Wang[3]**
[1]Department of Materials Science and Engineering, National Taiwan University of Science and Technology, Taiwan
[2]Department of Applied Physics, University of Gondar, Ethiopia
[3]Department of Materials and Minerals Resources Engineering, National Taipei University of Technology, Taiwan

Memory device is one of the most important products in the electronics market. To satisfy the needs of various current commercial electronic devices, such as computers, digital cameras, smart mobile phones and etc., non-volatile memories (NVMs) with huge storage capacities are needed. To overcome the problems of current NVM concepts, a variety of alternative memory concepts is explored. Among those memories, Resistive Random Access Memory (RRAM) NVMs based on electrically switchable resistance have attracted considerable attention. RRAM has gained significant interest as one of the most promising candidates as a next generation NVM device.

In this paper, resistive switching (RS) characteristics and mechanism of metal oxide RRAM device are studied. Based on an amorphous $(ZrCu)O_x$ active layer with a thin thickness of ~11nm is sputter deposited without substrate heating or post-annealing. The device shows forming-free unipolar RS properties of low operation voltage (<1.7V), long retention time, good endurance and resistance ratio. The RS property is considered to be dominated by the filamentary conduction due to the presence of oxygen vacancies in the grain boundary-free structure.

Keywords: Resistive Random Access Memory (RRAM), resistive switching, metal oxide, sputter deposited and oxygen vacancy.