INFLUENCE OF ELECTRODE THERMAL CONDUCTIVITY ON RESISTIVE SWITCHING BEHAVIOR DURING RESET PROCESS

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Resistive random access memory (RRAM) is the most promising candidate for non-volatile memory (NVM) due to its extremely low operation voltage, extremely fast write/erase speed, and excellent scaling capability. However, an obstacle hindering mass production of RRAM is the non-uniform physical mechanism in its resistance switching process. This study examines the influence of different electrode thermal conductivity on switching behavior during the reset process. Electrical analysis methods and an analysis of current conduction mechanism indicate that better thermal conductivity in the electrode will require larger input power in order to induce more active oxygen ions to take part in the reset process. More active oxygen ions cause a more complete reaction during the reset process, and cause the effective switching gap (dsw) to become thicker. The effect of the electrode thermal conductivity and input power are explained by our model and clarified by electrical analysis methods.

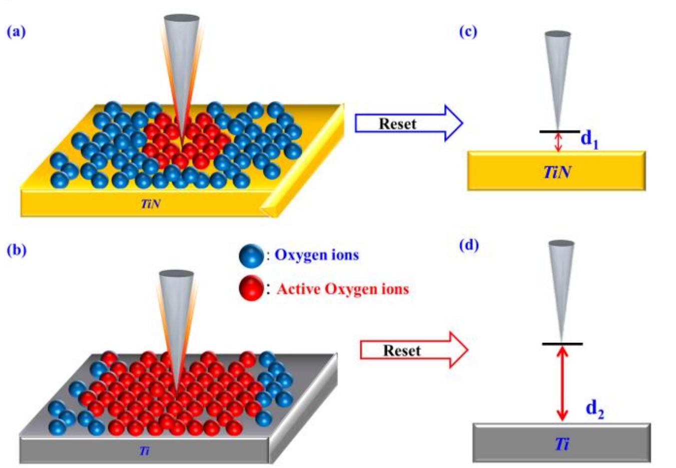

Figure 4. The physics mechanism schematic diagram (a) The quantity of active oxygen ions which can progress the redox reaction for the TiN switching active device (which is effectively induced by the heat) is less. (b) In the Ti switching active device, the quantity of active oxygen ions and the demand for input power are more for the Ti switching active device. (c) The lower quantity of active oxygen ions induces a thinner effective switching gap (dsw) after the reset process. (d) The higher quantity of active oxygen ions induces a thicker effective switching gap (dsw) after the reset process.

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