

Problem – functional oxides

Functional oxides offer unique electronic properties and functionalities to build reconfigurable and adaptable electronic functions beyond CMOS. Please choose the correct properties of MIT switches from the below statements.

1. Unipolar switching in functional oxides involves hysteretic 2-terminal devices where using the same sign of the voltage (exclusively positive or negative) one can program a highly conductive or a highly insulating state.
2. In switching applications of functional oxide devices one of the key performance factor consists in obtaining a low R_{on}/R_{off} ratio.
3. The switching speed of MIT devices is typically lower than the one of nanometer scale MOSFET transistor.
4. A 2-terminal VO_2 resistor can be used to build a spiking oscillator in combination with a FinFET transistor.
5. Stochasticity of VO_2 switches means that the off-on and on-off switching voltages are not fully identical and have a distribution that can be interpreted and modeled as an electrical probabilistic noise.
6. A gating with a negative capacitance ferroelectric gating could, in principle, help to increase the electric field at surface of a 3-terminal gated MIT switch and therefore reduce the switching voltage.
7. One can decrease the transition temperature of VO_2 material by doping with chromium (Cr).
8. In practice, a programmable capacitor using MIT/IMT material like VO_2 needs the integration of a heater to control the phase transition because there is no switching current in a passive capacitor device.
9. 2-terminal (with no gating) MIT switches can be used as pressure sensors of various inert gases.
10. At room temperature (300K), the subthreshold swing of a 2-terminal VO_2 switch is higher than 60mV/decade.

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