

High Entropy Oxides based on (Zr, Hf, Nb, Ta, Mo, W)O_x: From Powders to Resistively Switching RRAM Devices

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Tailored densification of high entropy ceramic targets (Ø 2-inch) by SPS for RF-sputtering of resistively switching thin films of various compositions within the system ZrO₂-HfO₂-Nb₂O₅-Ta₂O₅-MoO₆-WO₆ are reported along with their microstructural and crystallographic characterization (SEM, HRTEM, XRD ...). All single components of the high-order system are CMOS compatible and relevant to resistively switching thin film memristor devices, regarded as promising candidates for next generations of non-volatile memories (RRAM), with high storage density, fast switching kinetics, reduced power consumption, and the capability of in-memory computation. Compositions prepared show a kind of “cocktail effect” in the combinations of the original components: forming free behaviour of WO_x, excellent retention of HfO_x and high endurance of TaO_x. Densification of such targets via natural sintering is challenging, due to the sluggish sintering kinetics generally observed in high entropy systems. Therefore, SPS of powders that were synthesized via (a) solid-state reaction or (b) by chemical precipitation (enhancing homogeneity and reactivity) has been applied. Thin films prepared from the targets were characterized analytically (XPS, AFM, XRD ...) and used to fabricate memristor devices (4 µm²) showing partially faster switching at lower voltages, with higher Off/On ratio between two resistance states, as well as an excellent cycling endurance of over 10⁸ cycles compared to conventional TaO_x-films.

Professional Status of the Speaker

Senior Scientist

Interest in submitting a paper in a special issue of

No interest

Invitation letter for visa

No

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