RESISTIVE SWITCHING IN MIXED ALUMINUM OXIDE AND ZIRCONIUM OXIDE THIN FILMS

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In the search for well-performing resistive switching (RS) media, mixing different dielectric material layers is widely practiced, taking advantage of versatile possibilities of atomic layer deposition (ALD) technology. There are some attractive studies on RS of ZrO_2 as the host dielectric oxide [1,2], and few papers have reported RS of ALD-grown ZrO_2:Al_2O_3 mixtures [3]. In the present study, ZrO_2:Al_2O_3 films were grown to thicknesses in the range of 10-15 nm of by ALD using $Al(CH_3)_3$, $ZrCl_4$ and H_2O as precursors at 300 ^oC, whereas earlier the $AlCl_3$, as a precursor less prone to thermal decomposition has been applied in the processes [3]. In the present study, the ZrO_2:Al_2O_3 cycle ratios were, e.g., 24:1 and 4:1 with Al:Zr cation ratios varying between 0.04 and 0.4. The films demonstrated multiple clockwise bipolar RS with low to high resistivity window, remarkably, over five orders of magnitude in the conductivity scale (Fig. 1), clearly exceeding that observed earlier [3].]. Characteristics of some samples referred to multilevel RS. The forming voltages, though, were rather high ranging from 4 to 6 V. Interestingly the forming took place under positive voltage bias which is more common for counterclockwise RS. The effects of cycle ratios and sequencing on the crystalline structure, switching polarity and low to high resistivity ratios will be discussed.

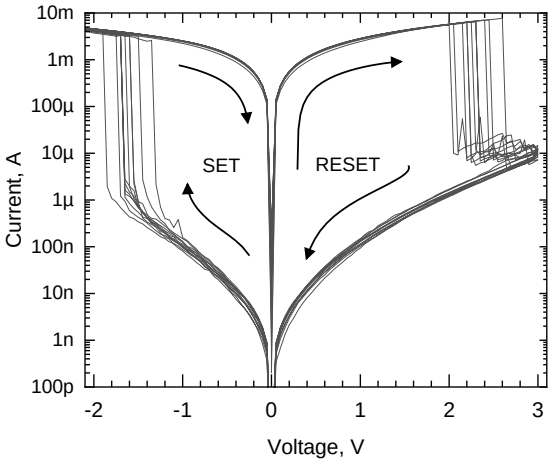

Fig. 1 Resistive switching current-voltage characteristic of a ZrO_2:Al_2O_3 film.

References

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