Electronic Supplementary Material (ESI) for Nanoscale
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Supporting Information

Performance improvement of resistive switching memory achieved by enhancing local-electric-field near electromigrated Ag-nanoclusters

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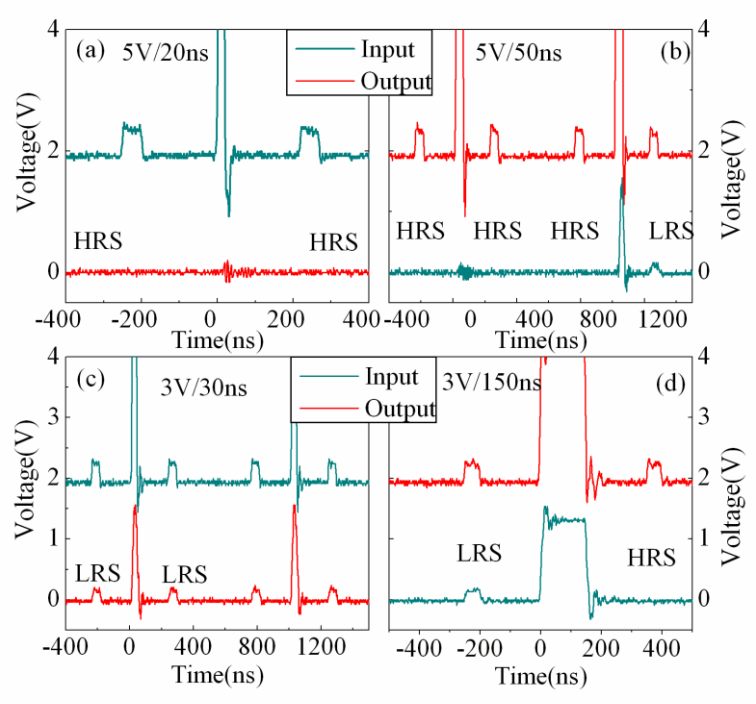

Figure S1 shows switching-speed measurement results of ZnO RRAM device without Ag nanoclusters (NCs). As can be seen in Fig. S1(a) and (c), the set [5V/20ns]/reset

[3V/30ns] pulses, which have been used to induce the resistive switching (RS) of the device with Ag NCs, can not switch on/off the device without Ag NCs. Even if the set pulse width is extended to 50 ns, there is still ~25% probability of RS failure (see Fig. S1(b)). In the reset process, an 150ns long pulse is required to switch off the device without Ag NCs (see Fig. S1(d)).

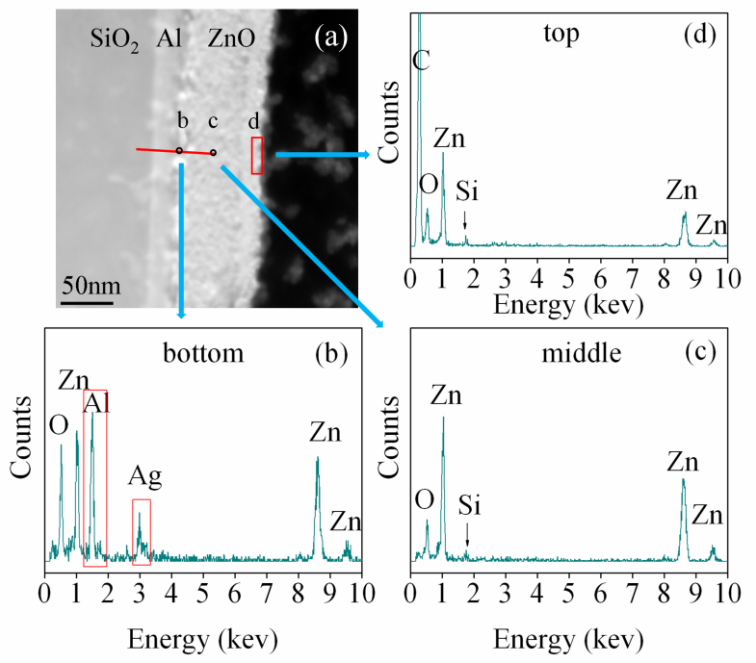

Figure S2 (a) shows a cross-sectional HADDF-STEM image of a fresh device. (b-d) show EDS spectra collected from the region b, c and d as marked in (a). The spectra in (b) and (c) are extracted from the line-scan EDS of Figure 3(a). The strong Ag and Al signals can be easily detected in the bottom electrode (region b). In contrast, no Ag and Al signals can be detected in the middle and top region (region c and d) of the film. According to the above data, it can be judged that the Ag only exists near the bottom electrode and does not diffuse into the top region in the fresh device.