

## Supporting Information

### Extremely Low Leakage Threshold Switch with Enhanced Characteristics *via* Ag Doping on Polycrystalline ZnO Fabricated by Facile Electrochemical Deposition for an X-Point Selector

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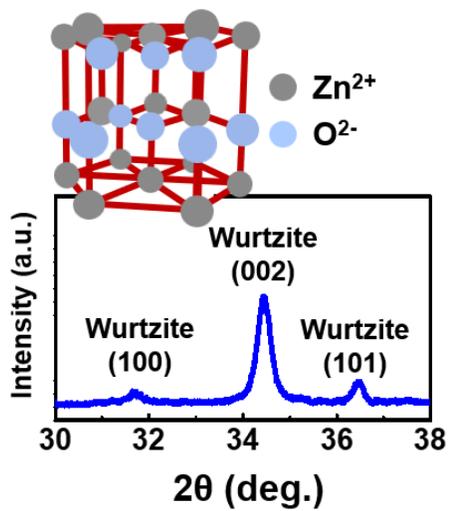


Figure S1. The XRD pattern of  $\theta/2\theta$  scan showing undoped ZnO SL is wurtzite structure.

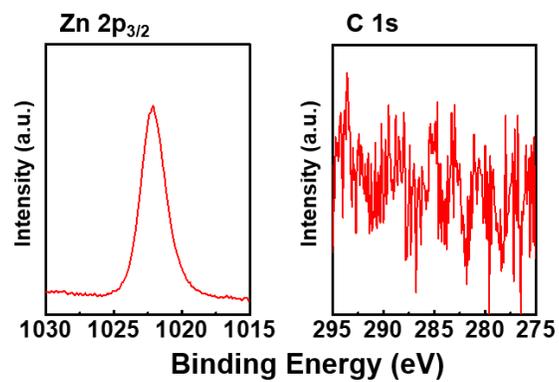


Figure S2. XPS analysis for Zn 2p<sub>3/2</sub> and C 1s narrow scans showing successful light doping of Ag without significant incorporation of impurities such as carbon.

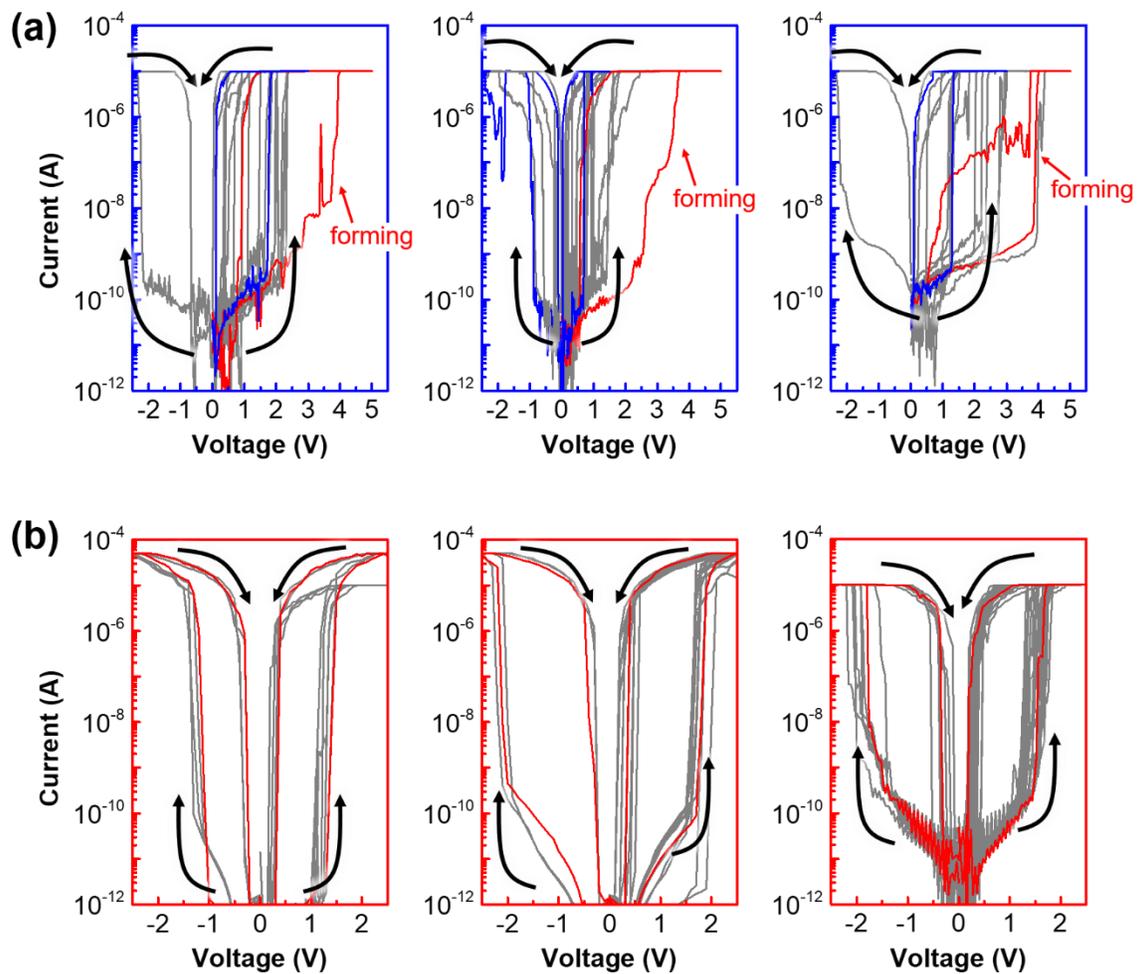


Figure S3. Examples of representative  $IV$  curves. Bidirectional threshold switching characteristics of (a) unlimited Ag provided from active electrode, and (b) limited Ag provided from doping are shown. The SL is undoped for (a) and is uniformly doped with Ag for (b). Electroforming is required for undoped ZnO as in (a) and self-compliance on-current can be remarked for the Ag-doped ZnO as in (b).

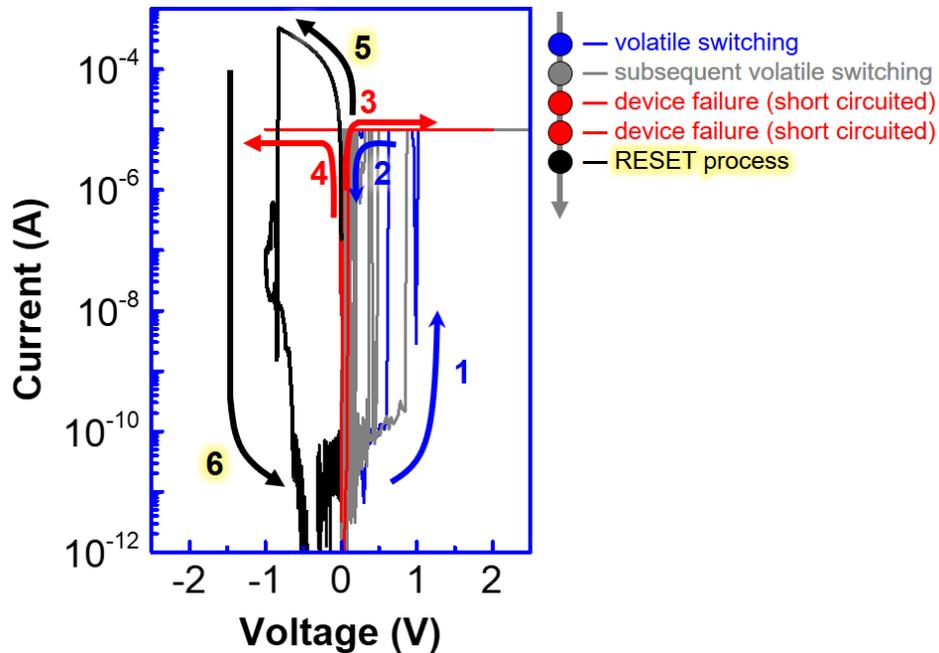


Figure S4. Example of DC  $IV$  curve demonstrating undoped Ag active electrode-based TS device requires reset process, after failure of the volatile switching behavior. First few DC sweeps show volatile switching (blue and gray). After several DC cycles, the TS device becomes short circuited (red, off-failure). To rupture the filament, larger current has been applied (*i.e.*, reset process).

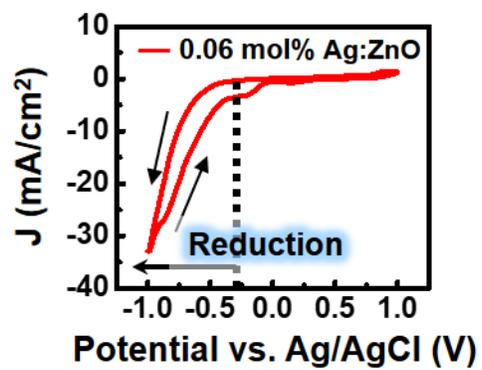


Figure S5. Cyclic voltammograms of Ag doped ZnO SL with concentration of 0.06 mol%.



Figure S6. Example capture on automation of consecutive DC *IV* sweeps for statistical analysis using LabView program.