Over one-billionth ($10^9$) reliable current changes observed in dilutely doped zinc oxide films

Un-Bin Han¹, Donghwa Lee² and Jang-Sik Lee¹*

¹Department of Materials Science and Engineering, Pohang University of Science and Technology (POSTECH), Pohang 790-784, Republic of Korea

²School of Materials Science and Engineering, Chonnam National University, Gwangju 61186, KOREA

*e-mail: jangsik@postech.ac.kr

Supplementary Information

Figure S1. Electrochemical analyses of Ag-doped ZnO layers. (a) Cyclic voltammograms of ZnO measured with various compositions. (b) Current-time transient of Pt working electrode during potentiostatic polarization at various compositions.
Figure S2. (a) TEM/Energy-dispersive X-ray spectroscopy (EDS) maps of distribution of Zn, Ag, and O elements on 0.06 mol% Ag-doped ZnO film. (b) TEM-EDS spectrum of 0.06 mol% Ag-doped ZnO film. (c) X-ray photoelectron spectroscopy (XPS) full survey of ZnO and 0.06 mol % Ag-doped ZnO film.
Figure S3. Electrical characteristics and switching mechanism of ZnO thin films according to Ag doping. (a) ZnO without Ag doping. (b) 0.02 mol% Ag-doped ZnO. (c) 0.1 mol% Ag doped ZnO.
**Figure S4.** Electrical characteristics of 0.06 mol% Ag-doped ZnO-based selection device obtained at various deposition time.
Figure S5. Electrical characteristics of 0.06 mol% Ag doped ZnO-based selection device obtained in air and vacuum conditions.
Figure S6. AC measurement of Ag-doped ZnO selection devices. Delay time of (a) 1 μs and (b) 100 ns.
Figure S7. AC response of the device at 100 ns pulse width.