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Supporting Information

Down-scaling of resistive switching to nanoscale using porous anodic alumina membranes

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Sample preparation

Fig. S1 shows a low-magnification SEM view on top of the Ag-filled AOO membrane. From the number of white spots (Ag nanowires embedded in the AAO matrix), one can see a very high degree of filling.

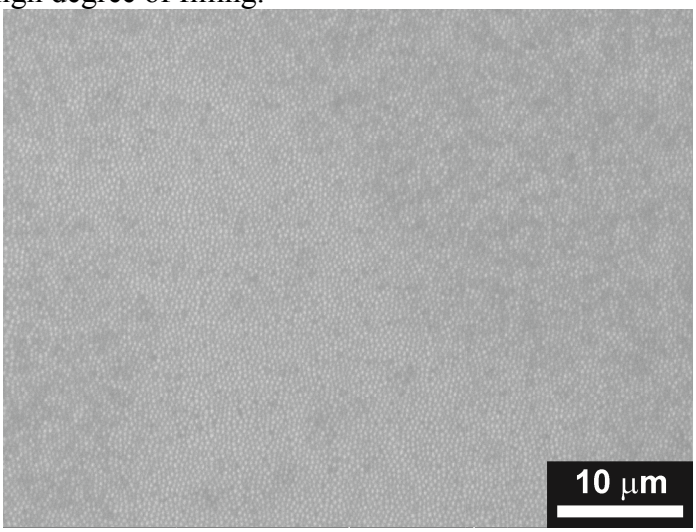

Fig. S1 SEM image of Ag-filled AAO membrane showing nearly all pores filled with Ag nanowires (white spots).

Electrical measurements

The electrical performance of all samples was measured using a complex setup consisting of optical microscope (Süss Microtec PSM 1000) mounted on manual probe system (Süss Microtec PM 5) equipped with microcontrolers (Süss Microtec pH 100) holding gold plated tungsten tips (American probe and technologies, Inc model 72G-F3/250x1.25) contacted to measurement unit (Keithley 2602 System SourceMeter). This setup enables to contact sample electrodes rigorously on electrodes and measure precisely sample resistivity. In the case of the samples of CELL AAO type, one probe was placed on Cu sample holder, whereas in the case of the cell planar it was placed directly on Ag electrode, as shown in Fig.2. The other probe was placed in both cases always on the Al electrode. The Keithley 2602 System SourceMeter

was controled by computer via script written in software Test Script Builder (version KTS-850E02).

Cyclic voltammograms (CVs) were obtained after applying set of pulses. For the CELL THIN the voltage was swept from 0 V to +0.35 V, than to -0.7 V and back to 0 V (where + voltage stands for positive voltage on the Ag electrode). Pulse voltage was changed with step 0.05 V and the pulse duration was 100 ms, individual pulses were separated by 100 ms delay. In the case of CELL AAO the pulse sequence was quite similar except of upper and lower voltage limits. The limits were set on fixed values +0.5 V and -0.5 V. The software was also able to automatically recognize any rapid change of resistivity accompanied by switch „on" or „off". If the change of resistivity during switch was as high as $R_{x+1}/R_x > 1000$ for switch „on" and $R_x/R_{x+1} > 100$ for switch „off" (where R_x and R_{x+1} represents resistivity obtained for two consecutive measurement voltages), then the software measured one more point and then reversed the direction of the voltage. This automatic regulation was a must for all samples of CELL AAO type, because higher voltages applied for already switched cell led to its irreversible destruction.

From the CV curves we evaluated the resistivity values of "on" and "off" state, marked as R_{on} and R_{off}. Resistivity values R_{on} and R_{off} were taken from the points (currents) recorded under the highest and the lowest voltage, respectively. Initial values $R_{init.}$ for both cell types were measured before the first switch under potential +0.05 V (where + stands for the positive voltage on the Ag electrode.