Supporting information:

Electric field induced simultaneous change of transport and magnetic properties in multilayered NiO_x/Pt nanowires

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S1. XRD patterns of the multilayered NiO_x/Pt NW arrays oxidized at 700 °C and 900 °C.

When the NiO_x/Pt NW arrays were oxidized at 900 °C, the diffraction peaks related with metallic Ni phase disappeared. It implies that the Ni in Ni/Pt NWs is completely oxidized into NiO. When the oxidizing temperature is high (≥ 700 °C), besides of the Ni, NiO, Pt peaks related with NW arrays, the diffraction peaks of Al_2O_3 from PAA template are observed, which may be due to the enhanced crystallinity of PAA.[1]

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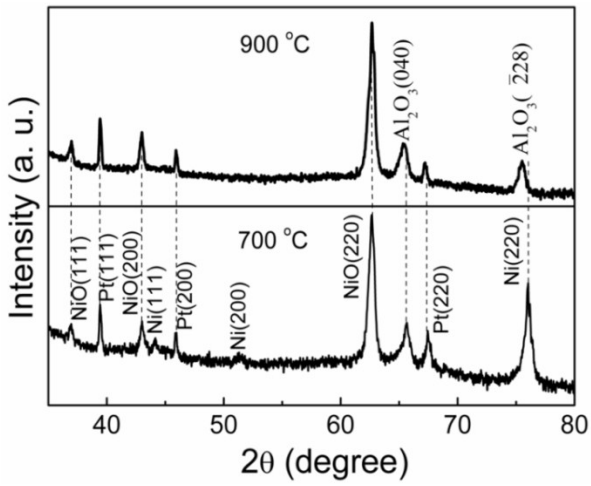

Fig. S1 XRD patterns of the multilayered NiO_x/Pt NW arrays oxidized at 700 °C and 900 °C.

S2. HAADF-STEM image of Ni/Pt NWs and elemental maps of Ni and Pt.

Figure a−c shows the HAADF-STEM image of Ni/Pt NW and elemental maps of Ni and Pt, respectively. The results reveal that the NWs have a uniform diameter of approximately 70 nm with the alternating thickness of about 50 nm Ni and 10 nm Pt.

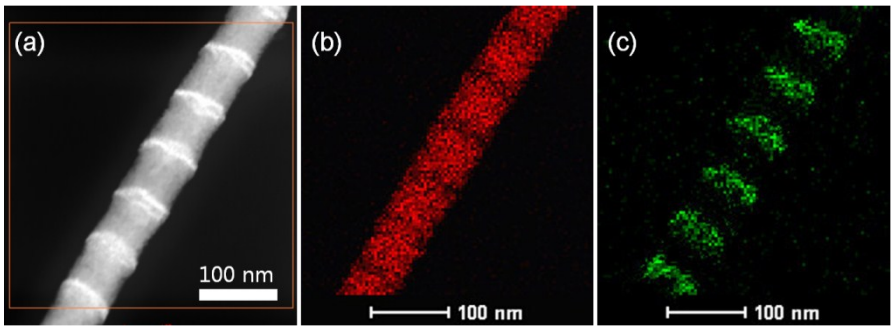

Fig. S2 (a) HAADF-STEM image of Ni/Pt NW and elemental maps of (a) Ni and (b) Pt.

S3. EDS spectra of Ni/Pt NWs.

The traces of the C and Cu elements come from C membrane and Cu grid, respectively.

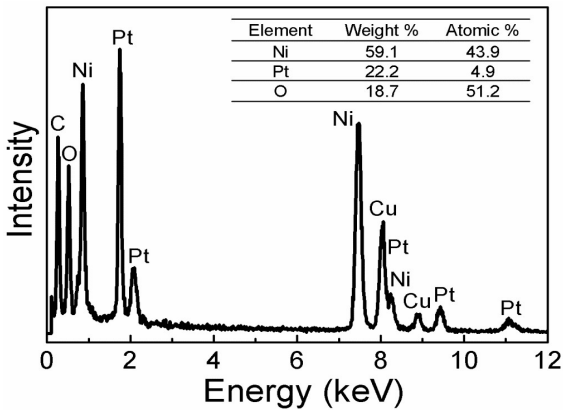

Fig. S3 EDS spectrum of Ni/Pt NWs.

S4. XPS spectra of Pt 4f in NiO_x/Pt NWs oxidized at 500 °C and 600 °C and Ni 2p in NWs oxidized at 500 °C.

The Pt 4f spectra of the NiO_x/Pt NWs oxidized at 500 °C and 600 °C show the same peaks at binding energy of about 71.1 and 74.4 eV, which corresponding to the metallic Pt. Additionally, according to the integral area ratio of metallic Ni peak area to total Ni 2p peak, the metallic Ni atomic concentration for the NWs oxidized at 500 °C is about 6.2%.

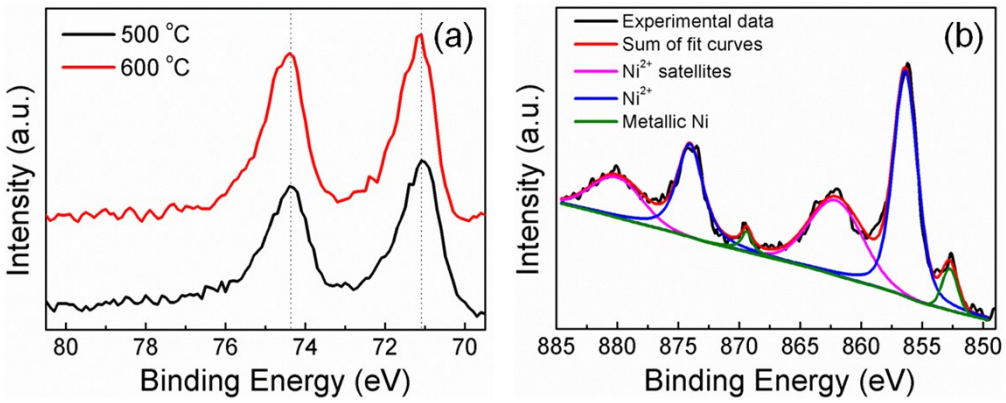

Fig. S4 (a) XPS spectra of Pt 4f in NiO_x/Pt NWs oxidized at 500 °C and 600 °C. (b) XPS spectrun of Ni 2p in NiO_x/Pt NWs oxidized at 500 °C.

S5. *I−V* curves of multilayered NiO_x/Pt NW devices oxidized at 700 °C and 900 °C.

An electroforming process is required to initiate RS for the NWs oxidized at 700 °C and 900 °C. The forming voltages are 6 V and 10 V for NWs oxidized at 700 °C and 900 °C, respectively. The average V_{set} values of NiO_x/Pt NWs oxidized at 700 °C and 900 °C are 1.32 V and 1.5 V, respectively. The R_{HRS}/R_{LRS} is about 10^4 and 10^5, respectively.

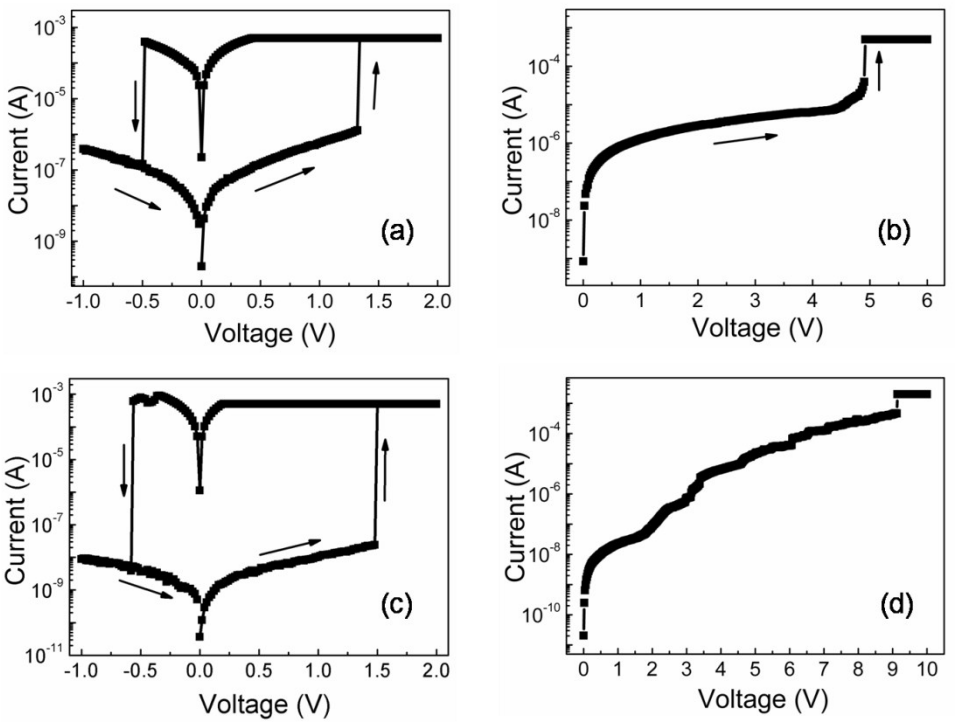

Fig. S5 *I−V* curves of multilayered NiO_x/Pt NW devices oxidized at 700 °C (a) and 900 °C (c); (b) and (d) are the corresponding electroforming processes.

S6. *I−V* curves of multilayered NiO_x/Pt NW devices with different NiO_x thicknesses.

With increasing the NiO layer thickness (t_{NiOx}), the average V_{set} and V_{reset} values are increased in the operations. For the RS device with t_{NiOx}=25 nm, it exhibits a low

on/off ratio and a poor stability. For the RS device with a large NiO_x thickness, a large switching voltage is needed, which is not beneficial to reduce the power consumption.

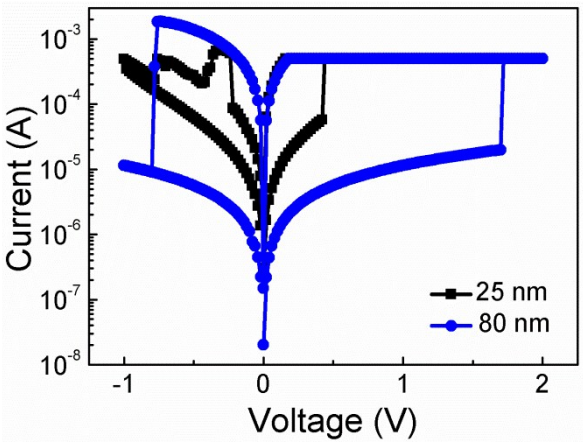

Fig. S6 $I-V$ curves of multilayered NiO_x/Pt NW devices with different NiO_x thicknesses.

1. L. Liu, W. Lee, R. Scholz, E. Pippel and U. Gosele, Angew. Chem. Int. Edit., 2008, **47**, 7004−7008.