Supplementary Information for

Electrochemical Metallization Switching with a Platinum Group Metal in Different Oxides

Zhongrui Wang[a], Hao Jiang[a], Moon Hyung Jang[a], Peng Lin[a], Alexander Ribbe[b], Qiangfei Xia[a‡], and J. Joshua Yang[a]*

[a]Department of Electrical and Computer Engineering, University of Massachusetts, Amherst, MA 01003, USA

[b]Department of Polymer Science and Engineering, University of Massachusetts, Amherst MA 01003, USA

Corresponding authors: [‡]qxia@ecs.umass.edu; [*]jjyang@ecs.umass.edu

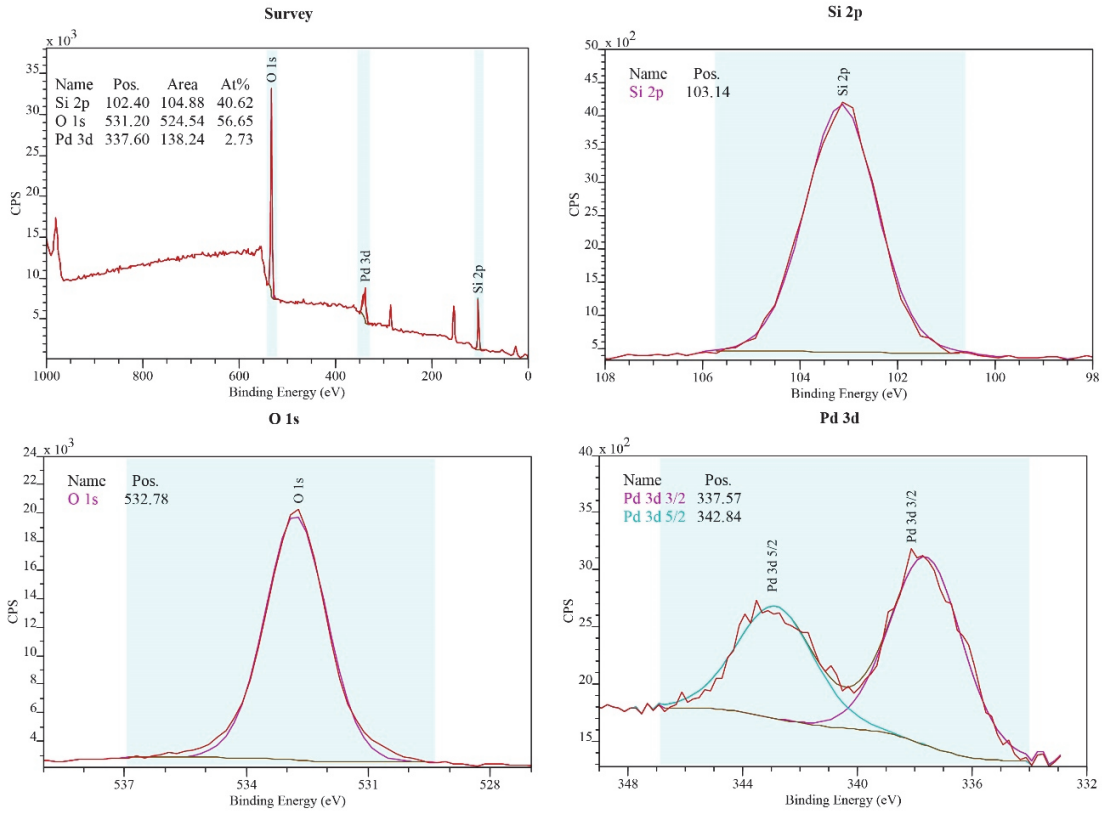

Figure S1 X-ray Photoelectron Spectroscopy (XPS) spectrum of the as deposited SiO_x:Pd film of a thickness about 20 nm on Pt substrate. The Si 2p, O 1s, and Pd 3d peaks are aligned by assuming a binding energy of adventitious C 1s to be 284.8 eV.

The atomic concentration ratio is investigated by XPS for a 20 nm SiO_x:Pd film on Pt substrate. The atomic percentage between Pd and Si is ~1:15, as shown in Fig. S1.

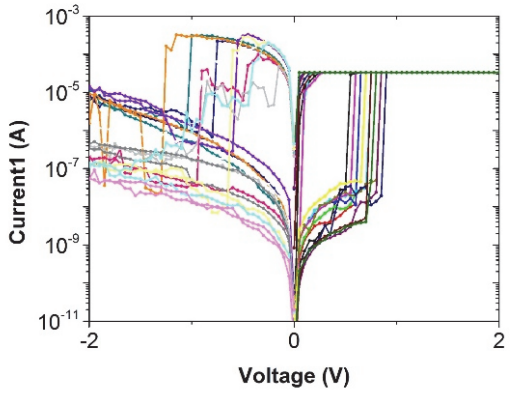

Figure S2 The DC I-V of resistive switching in a vertically stacked Pt/SiO_x:Pd/Pt junction by using positive biasing on the top electrode to SET and negative biasing to RESET.

The switching polarity is largely determined by the electroforming process, which creates specific filament geometry and ion distribution profile in the device that favours a certain switching polarity. Fig. S2 shows the reversed electrical operation of the Pt/SiO_x:Pd/Pt junction by SET the device of Fig. 6 (c) of the main text with positive biasing on the top electrode. And the device can be RESET with negative biasing on the top electrode.

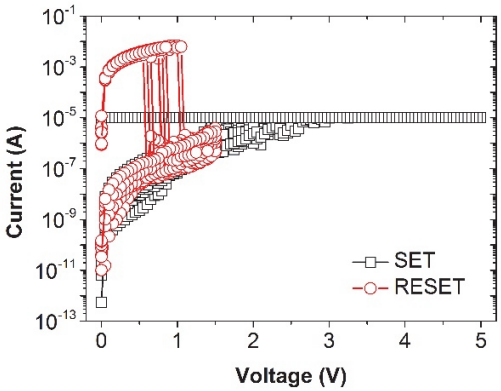

Figure S3 Unipolar switching behaviours of un-doped SiO_x device.

Un-doped SiO_x devices with identical geometric configurations with that of Fig. 6(c) of the original manuscript shows unipolar switching behaviours as those reported in the Ref 1. However, the unipolar switching shown in Fig. S3 may possess a different origin with that shown in Fig. 6(c) of the main text. The maximum RESET current experienced in Fig. S3 is between 2mA to 10 mA. On the other hand, the maximum RESET current associated with the doped SiO_x:Pd is between 30 to 200 μA. Such small RESET current is rarely seen in un-doped oxide unipolar RRAM as the unipolar switches typically rely on large heating power to melt filaments. Instead, the observed bipolar switching in Fig. 6(c) of the main text shares some similarities with doped SiO_x memristor, for instance Cu doped SiO_x[2], which may suggest that it is Pd migration oriented.

References

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2. C. Schindler, S. C. P. Thermadam, R. Waser and M. N. Kozicki, *IEEE Transactions on Electron Devices*, 2007, **54**, 2762-2768.