# Supporting information

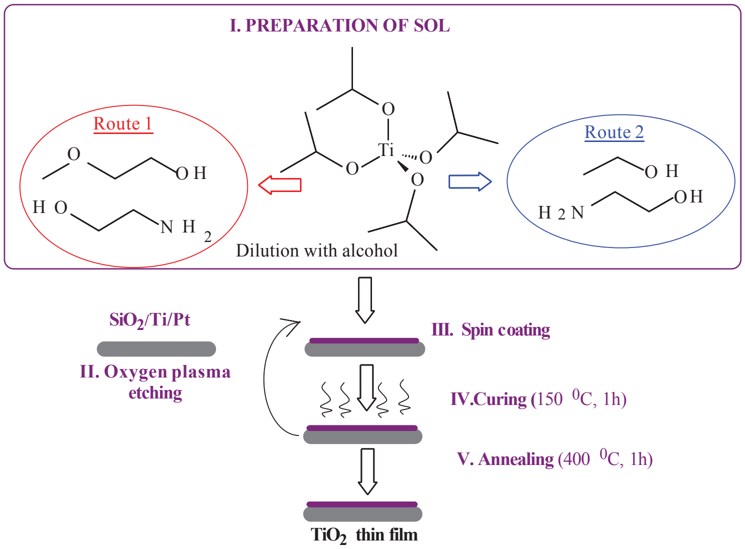

**Fig. S1.** Key steps of $TiO_2$ thin films preparation.

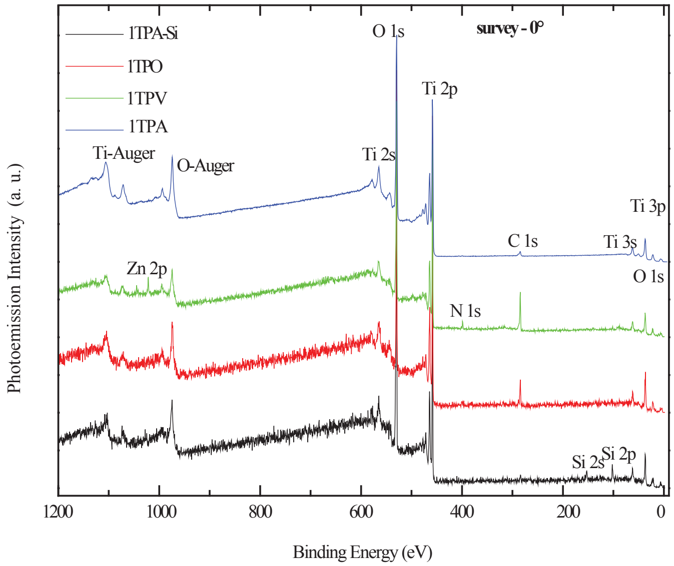

**Fig. S2.** Surveys of $TiO_2$ samples annealed in air (**1TPA**), oxygen (**1TPO**), vacuum (**1TPV**), and Si-contaminated oven (**1TPA-Si**).

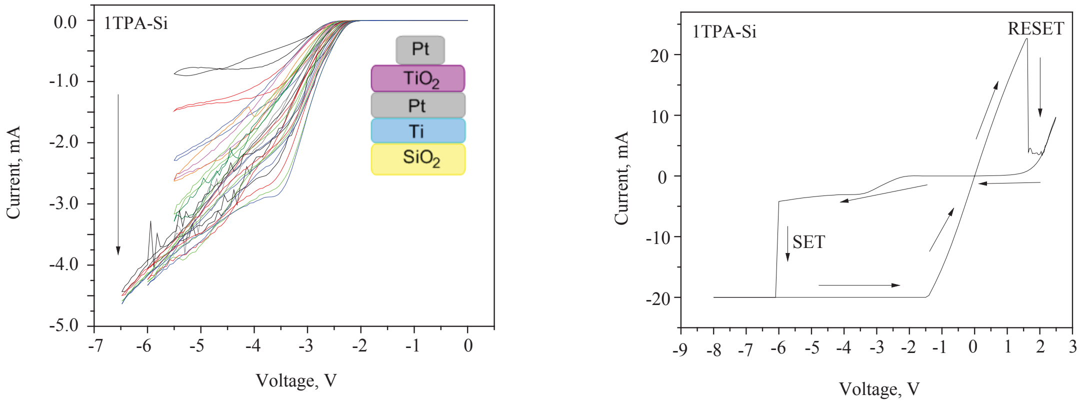

**Fig. S3.** Gradual electroforming of **1TPA-Si** with a compliance current of 20 mA and 60 s sweeps (left). First SET (20 mA compliance current, 60 s) and RESET (30 mA compliance current, 60 s) of **1TPA-Si** (right).

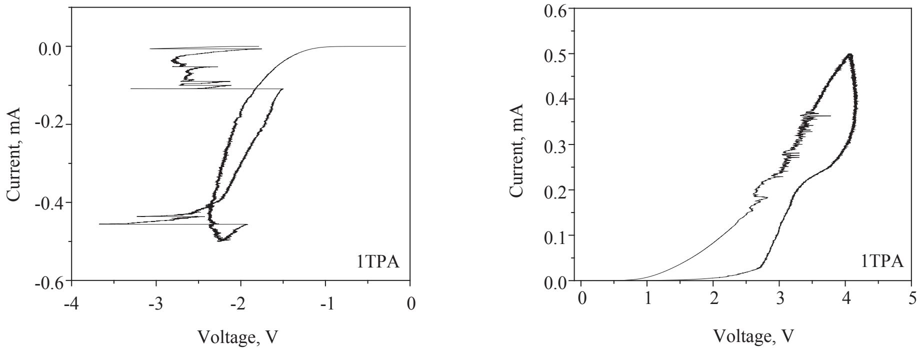

**Fig. S4**. Current-controlled electroforming of **1TPA** with Pt top dish electrode, ± 500 µA sweep with 100 nA step and a compliance current of 15 V.

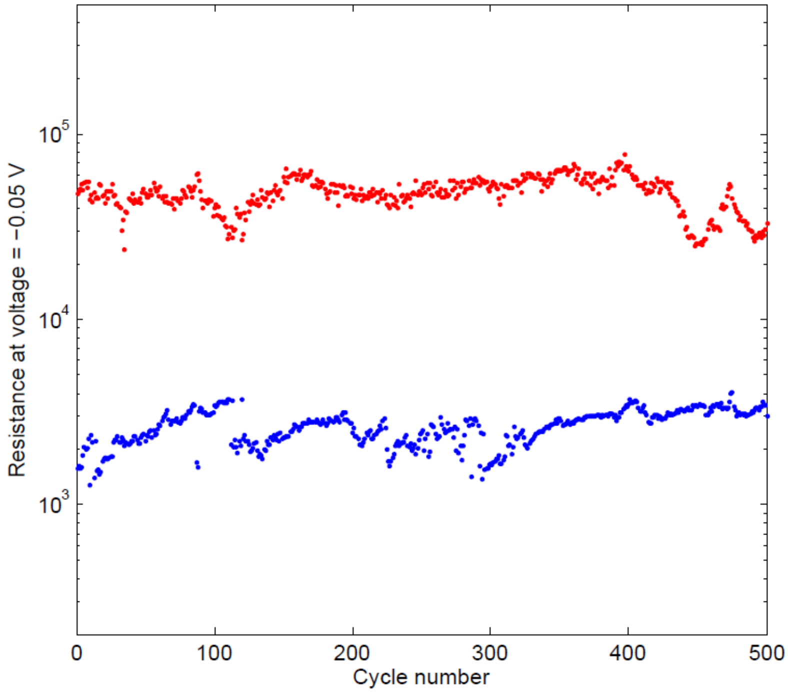

**Fig. S5**. Endurance of **1TPA** with Pt top dish electrode.