Electronic Supplementary Material (ESI) for Energy & Environmental Science

Supporting information

On chip, all solid-state and flexible micro-supercapacitors with high performance based on MnO_x/Au multilayers

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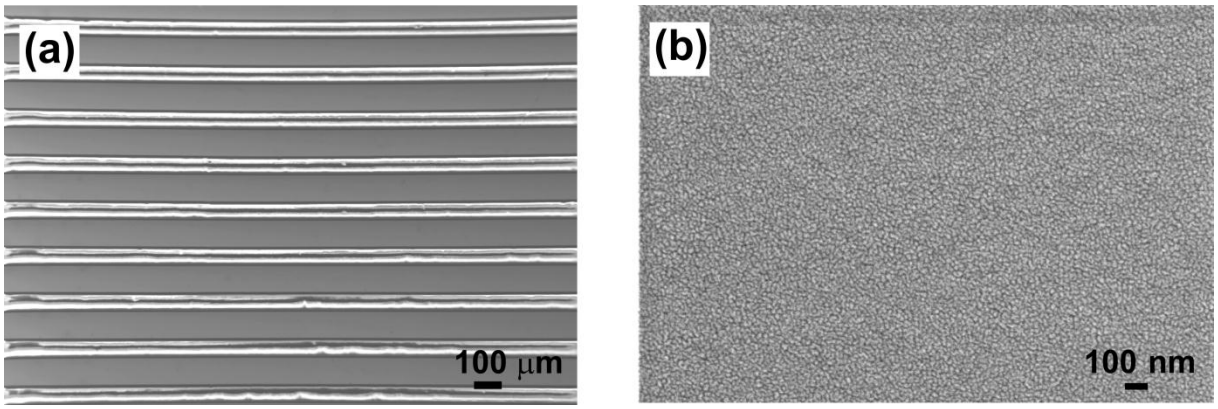

Figure. S1. (a) A low magnification, and (b) high magnification SEM images of MnO_x/Au multilayers on PET substrate, showing the particle size is around 15 nm.

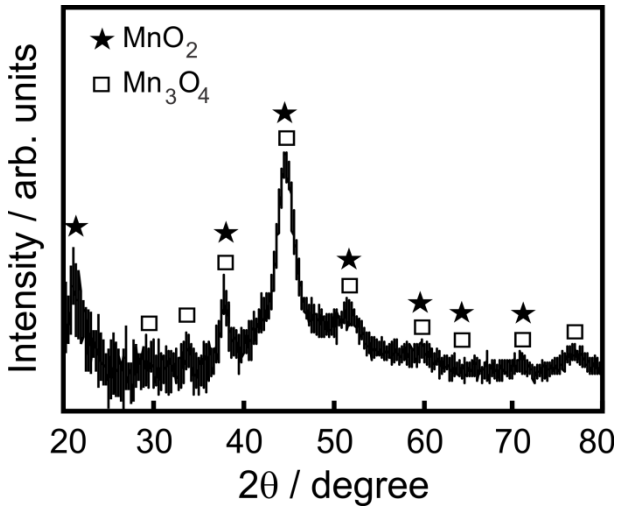

Figure. S2. X-ray diffraction pattern of the as-prepared MnO_x film, which is confirmed to be a mixture of crystalline MnO_2 and Mn_3O_4.

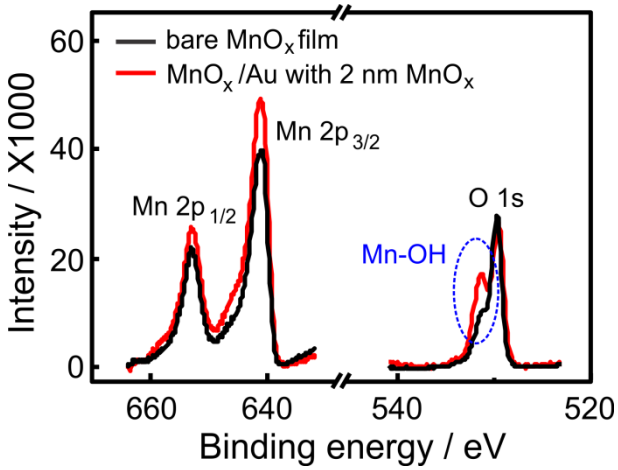

Figure S3. X-ray photo-electron spectroscopy (XPS) characterization of bare MnO_x film and MnO_x/Au film with 2 nm MnO_x on top of gold to investigate the MnO_x/Au interface. Compared to bare MnO_x film, MnO_x/Au film with 2 nm MnO_x exhibits more surface OH oxygen in O 1s (the part circled by blue dashed ellipse), which is probably due to the gold influence at the interface.

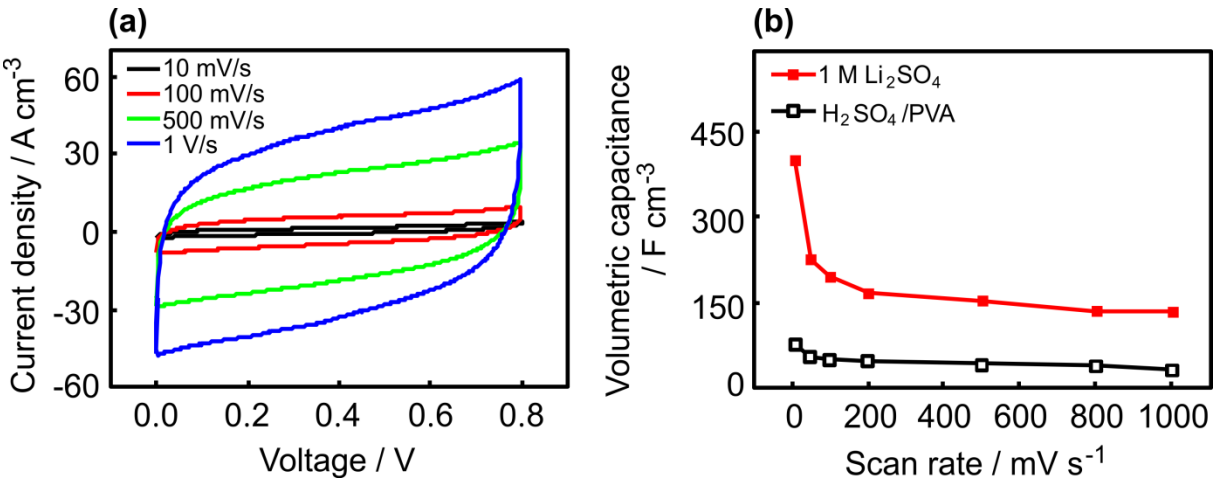

Figure S4. (a) Cyclic voltammetry curves of the MnO_x/Au multilayer micro-supercapacitor measured in 1 M Li_2SO_4 at scan rates from 10 mV s^{-1} to 1 V s^{-1}. (b) Comparison of volumetric capacitance for MnO_x/Au multilayers measured in aqueous (1 M Li_2SO_4) and gel (H_2SO_4/PVA) electrolyte at scan rates (10, 50, 100, 200, 500 and 1000 mV s^{-1}).

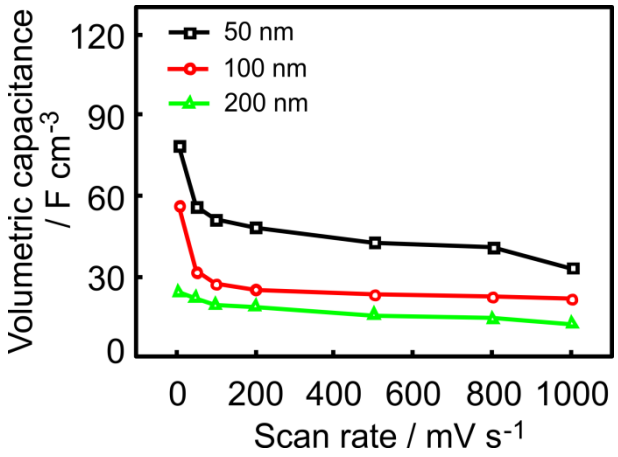

Figure S5. Comparison of the volumetric capacitance at scan rates (10, 50, 100, 200, 500 and 1000 mV s^{-1}) for MnO_x/Au multilayers with thickness of 50 nm, 100 nm, 200 nm. The 50 nm-multilayer is stacked in the order of MnO_x/Au/MnO_x/Au/MnO_x, by three layers of 15 nm-MnO_x and two layers of 2.5 nm-Au. The 100 nm-multilayer is stacked in the same order, by three layers of 30 nm-MnO_x and two layers of 5 nm-Au. Considering thick layer may impede the electrochemical activity of MnO_x, the 200 nm-multilayer is stacked by nine layers, with five layers of 36 nm-MnO_x and four layers of 5 nm-Au layers. As shown in this figure, the 50 nm-multilayer exhibits the highest volumetric capacitance.

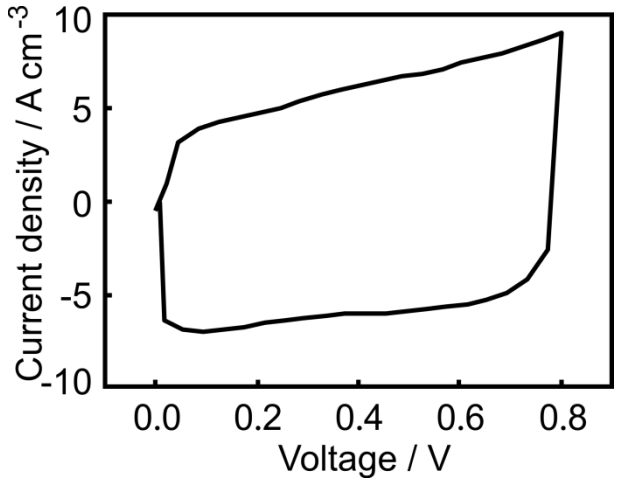

Figure S6. Cyclic voltammetry curve of MnO_x/Au multilayer micro-supercapacitor measured at a scan rate of 1 V s^{-1} after the strain test.