Supporting Information

Vertically Fingerlike Asymmetric Supercapacitors for Enhanced Performance at Higher Mass Loading and Inner Integrated Photodetecting Systems

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The volumetric capacitance of the device can be calculated from CV results by the following equations:

$$C = A/(2 \times s \times \Delta U) \quad (1)$$

$$C_V = C/V = A/(2 \times s \times V \times \Delta U) \quad (2)$$

Where C is the capacitance of the ASC, A is the area of CV curve, s is the scan rate, ΔU is the potential window, C_V is the volumetric capacitance, and V is the total volume of the electrodes.

The volumetric capacitance of the device can be calculated from GCD results by the following equations:

$$C = I \times \Delta t / \Delta U \quad (3)$$

$$C_V = C/V = I \times \Delta t / (V \times \Delta U) \quad (4)$$

Where C is the capacitance of the ASC, I is the discharge current, Δt is the discharge time, ΔU is the potential window during the discharge process, C_V is the volumetric capacitance, and V is the total volume of the electrodes.

The energy density and average power density derived from the GCD of the device can be calculated from the following equations:

$$D_E = 0.5 C_V (\Delta U)^2 \quad (5)$$

$$D_P = 3600 D_E / \Delta t \quad (6)$$

Where D_E is the energy density, C_V is the volumetric capacitance which can be obtained through Eq. 4, ΔU is the potential window, D_P is the volumetric power density and Δt is the discharge time.

The capacity retention (CR) and Coulombic efficiency (CE) can be calculated from GCD results by the following equations:

$$CR = \Delta t / \Delta t_0 \quad (7)$$

$$CE = \Delta t_d / \Delta t_c \quad (8)$$

Where Δt is the discharge time of different cycles, Δt_0 is initial discharge time, Δt_d is the discharge time and Δt_c is the charge time in same cycle.

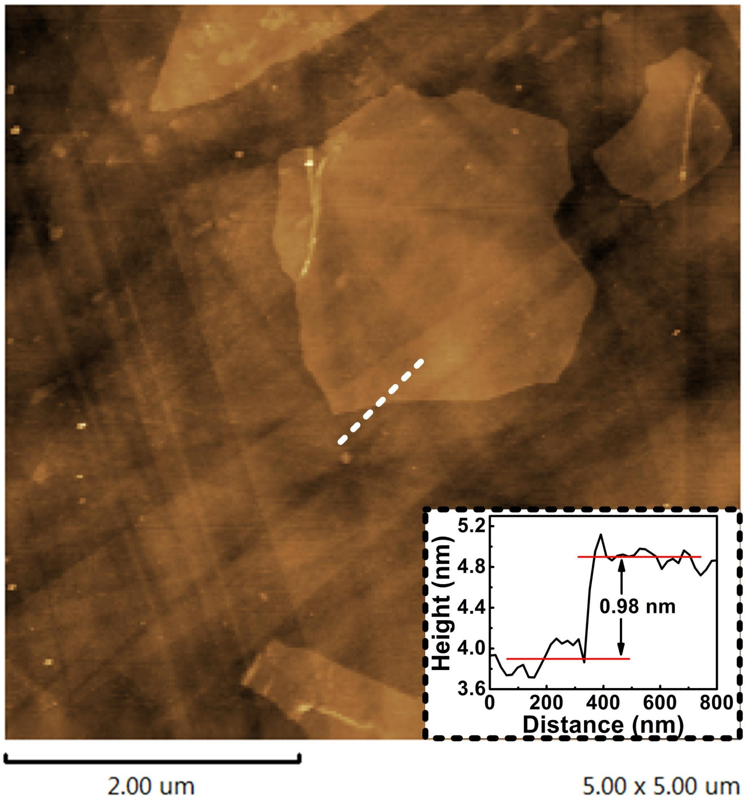

Fig. S1 AFM image and height profile of GO.

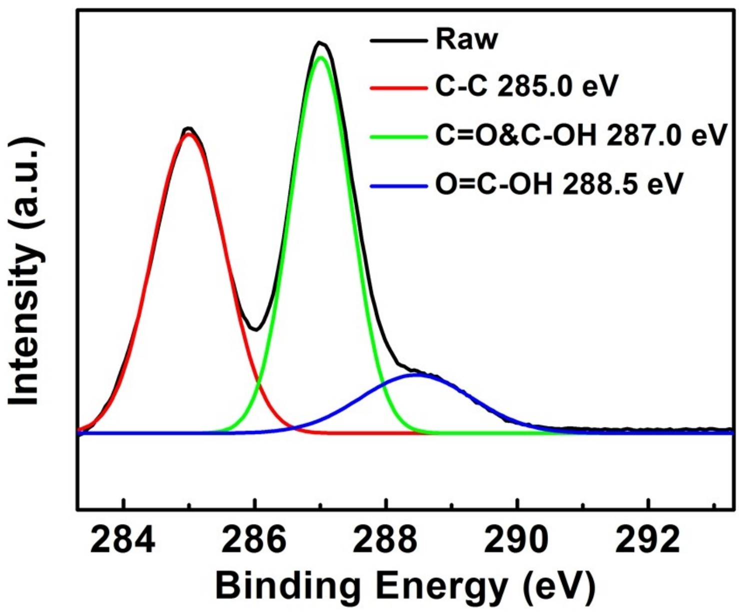

Fig. S2 C1s XPS spectra of GO.

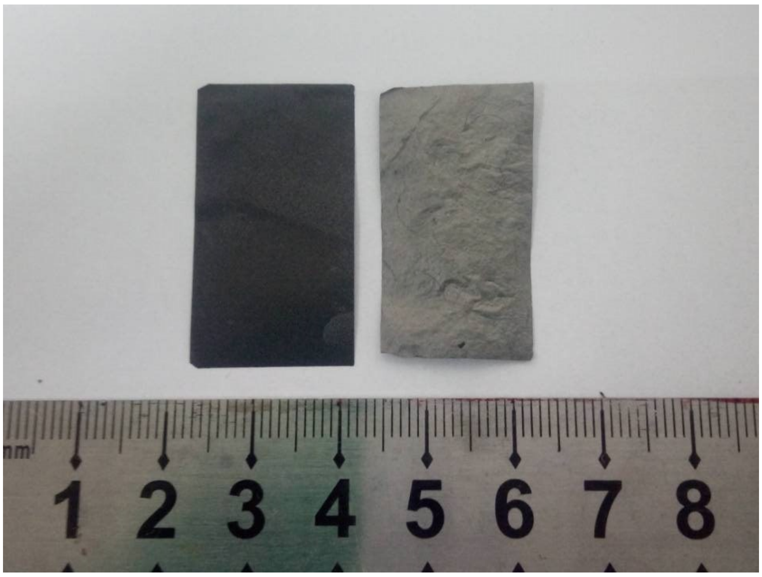

Fig. S3 Photographs of RGO film before (left) and after (right) being annealed.

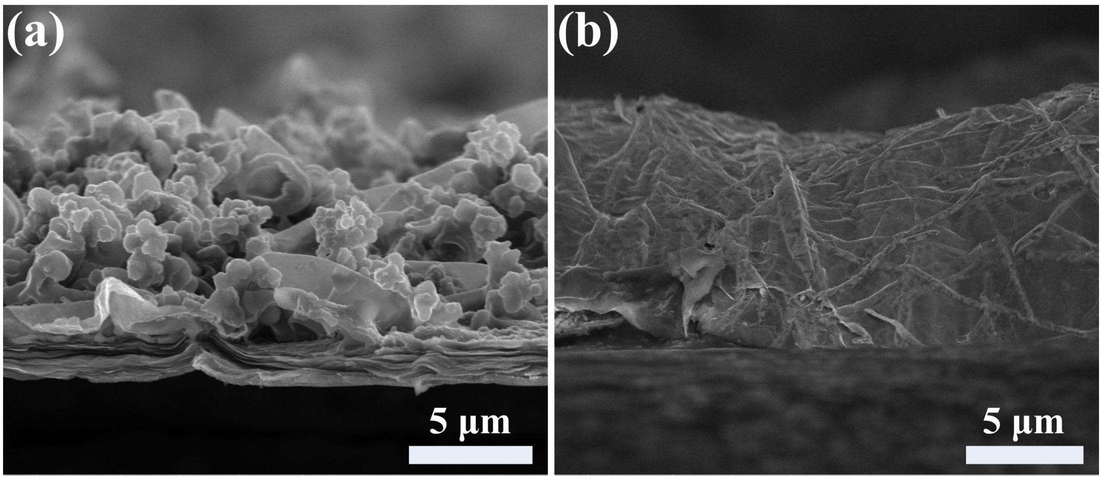

Fig. S4 Side views of positive and negative electrodes. (a) RGO-MnO_2-PPy, the thickness is 10 μm. (b) RGO-MoO_3, the thickness is 12 μm.

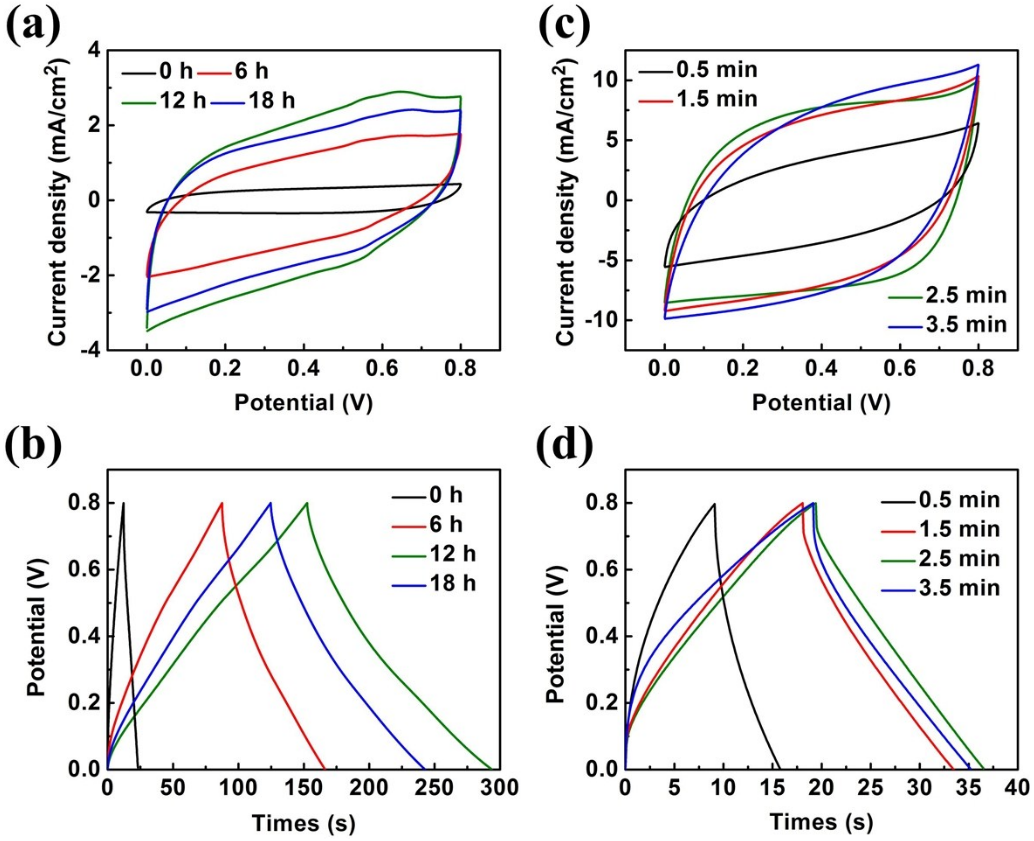

Fig. S5 Electrochemical performances of RGO based electrodes. (a) CV curves (scan rate: 50 mV s^{-1}) and (b) GCD curves (current density: 0.4 mA cm^{-2}) of RGO-MnO_2 electrodes with various MnO_2 deposition times. (c) CV curves (scan rate: 50 mV s^{-1}) and (d) GCD curves (current density: 6.4 mA cm^{-2}) of RGO-MnO_2-PPy electrodes with various PPy deposition times.

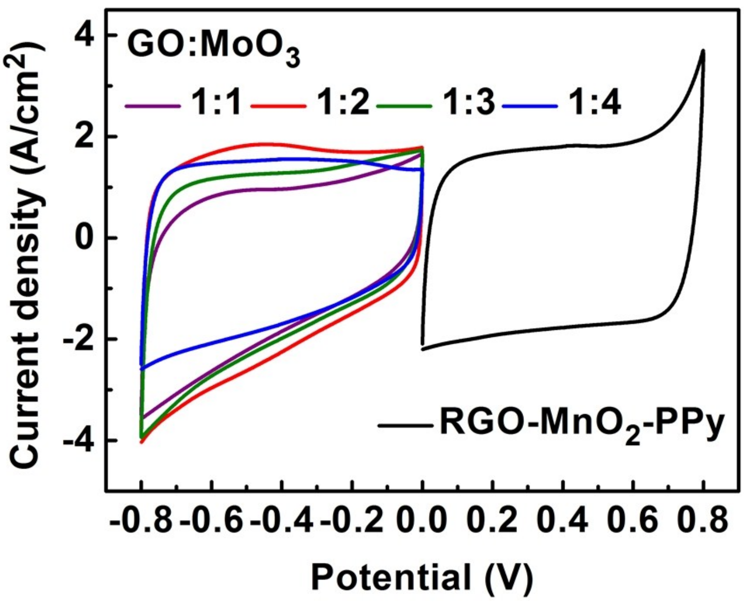

Fig. S6 CV curves of RGO-MnO_2-PPy and RGO-MoO_3 (various ratios) at a scan rate of 10 mV s^{-1}.

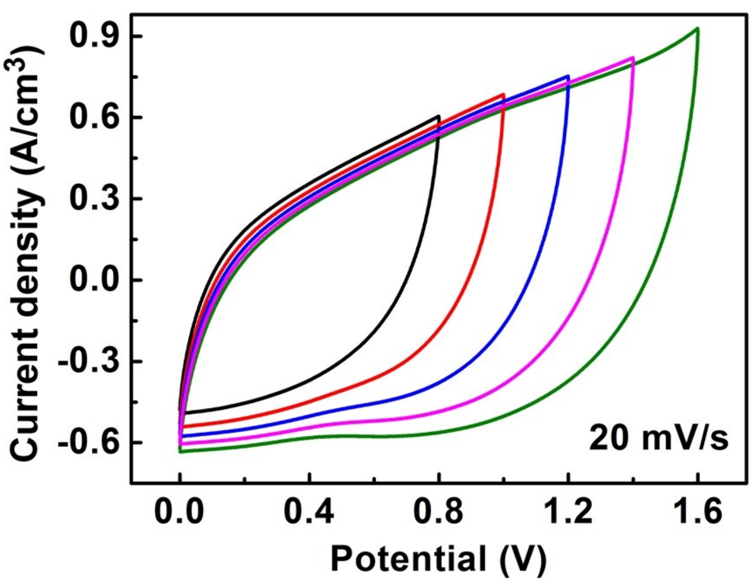

Fig. S7 CV curves of the ASC in various potential windows.

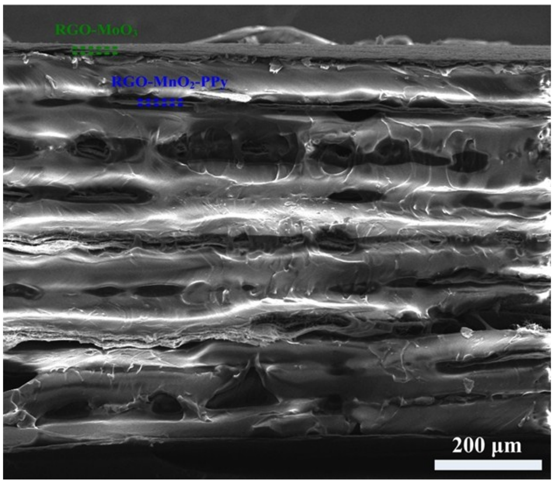

Fig. S8 Side view of VFASC with 10 fingerlike electrodes. The RGO-MnO_2-PPy positive electrodes and RGO-MoO_3 negative electrodes were stacked one by one.

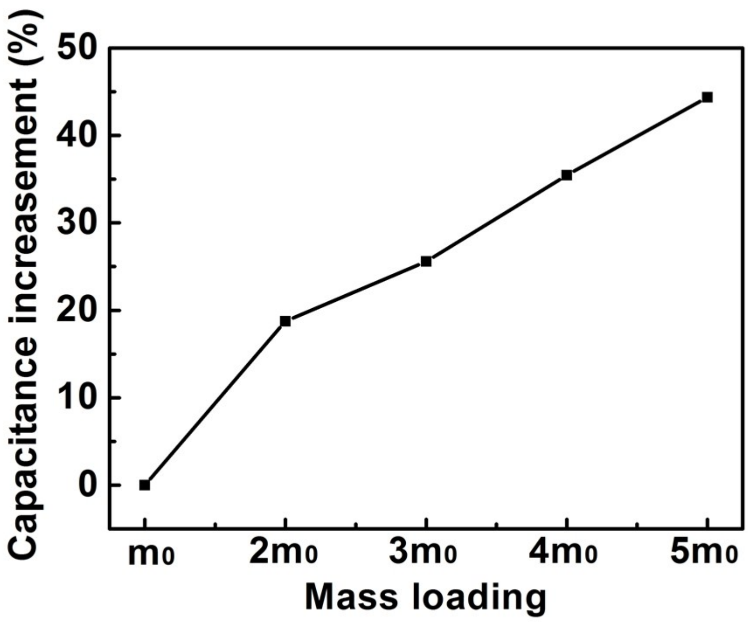

Fig. S9 Capacitance increasement *vs* mass loading.

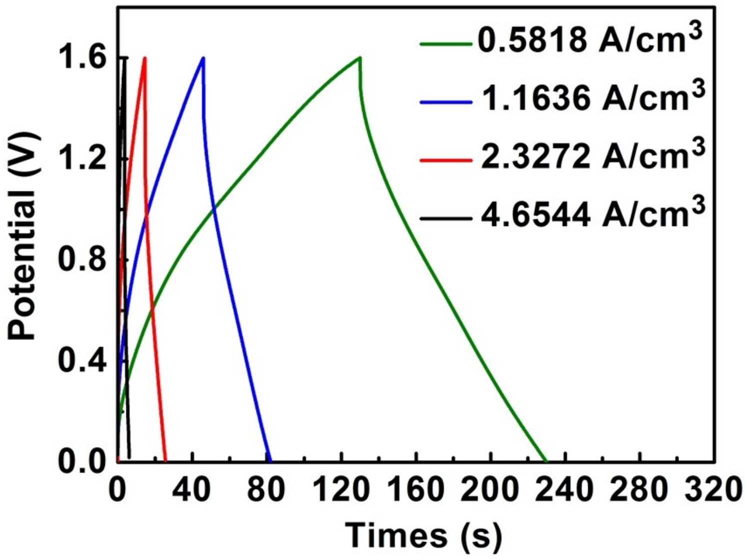

Fig.S10 GCD curves of the VFASC at various current densities.

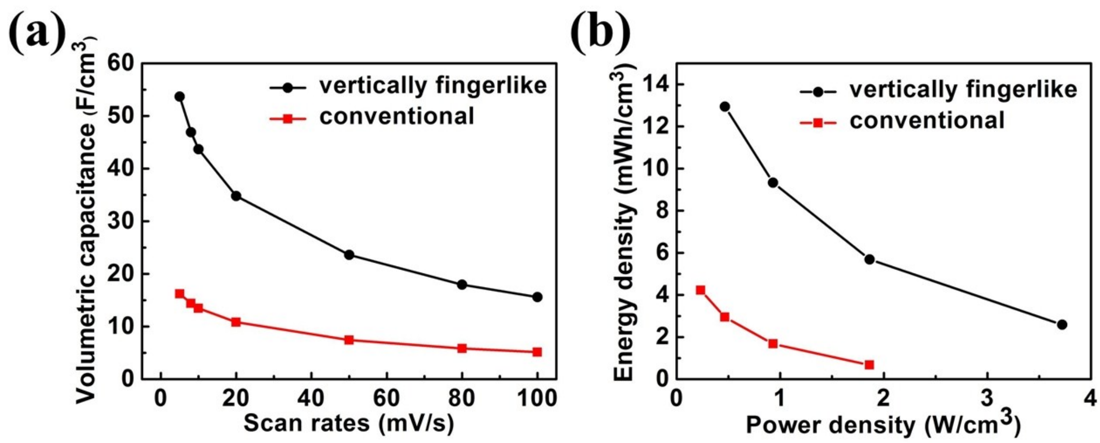

Fig.S11 The comparison of electrochemical performance for vertically fingerlike and conventional asymmetric supercapacitors. (a) Volumetric capacitance vs. scan rate. (b) Energy and power density plot.