Supporting information

Improved performance of asymmetric fiber-based micro-supercapacitors using carbon nanoparticles for flexible energy storage

Huanyu Jin[a], Limin Zhou[b], Chee Leung Mak[a], Haitao Huang[a], Wing Man Tang[a,], and Helen Lai Wa Chan[a]*

[a]Department of Applied Physics, The Hong Kong Polytechnic University, Hung Hom, Hong Kong

[b]Department of Mechanical Engineering, The Hong Kong Polytechnic University, Hung Hom, Hong Kong

*Correspondence author: wmtang@polyu.edu.hk (WMT)

Calculations. The volumetric capacitance (C_v) of the electrodes was calculated through the following equation:

$$C_v = I\Delta t/(V\Delta E) \qquad (1)$$

where I is the discharge current, Δt is the discharge time, ΔE is the potential window during

the discharge process (after IR drop), and V is the effective volume of the carbon fiber electrode.

C_v of the electrodes could be also calculated from the CV curves using the following equation (2):

$$C_v = A/(2Vs\Delta E) \qquad (2)$$

where A is the area of the CV curve and s is the scan rate.

Volumetric energy density (E_v) and power density (P_v) of the SC device are calculated by following equations:

$$E_v = 0.5C_d(\Delta U)^2/V_d \qquad (3)$$

$$P_v = E_v/\Delta t \qquad (4)$$

where C_d is the capacitance of the SC device, V_d is the volume of the SC device, ΔU is the operating voltage of the SC device and Δt is the discharging time.

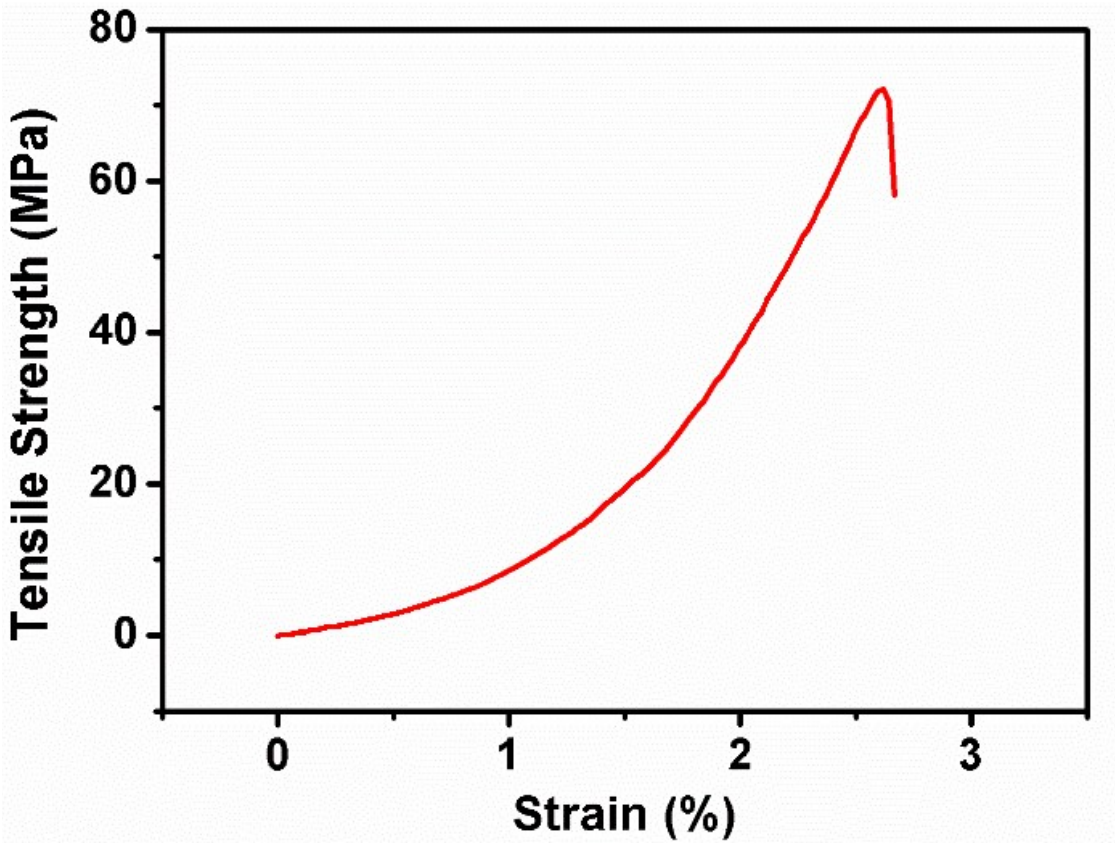

Figure S1. The tensile strength versus strain curve of the MCNP electrode as measured by a tensile and compression tester (INSTRON 5944).

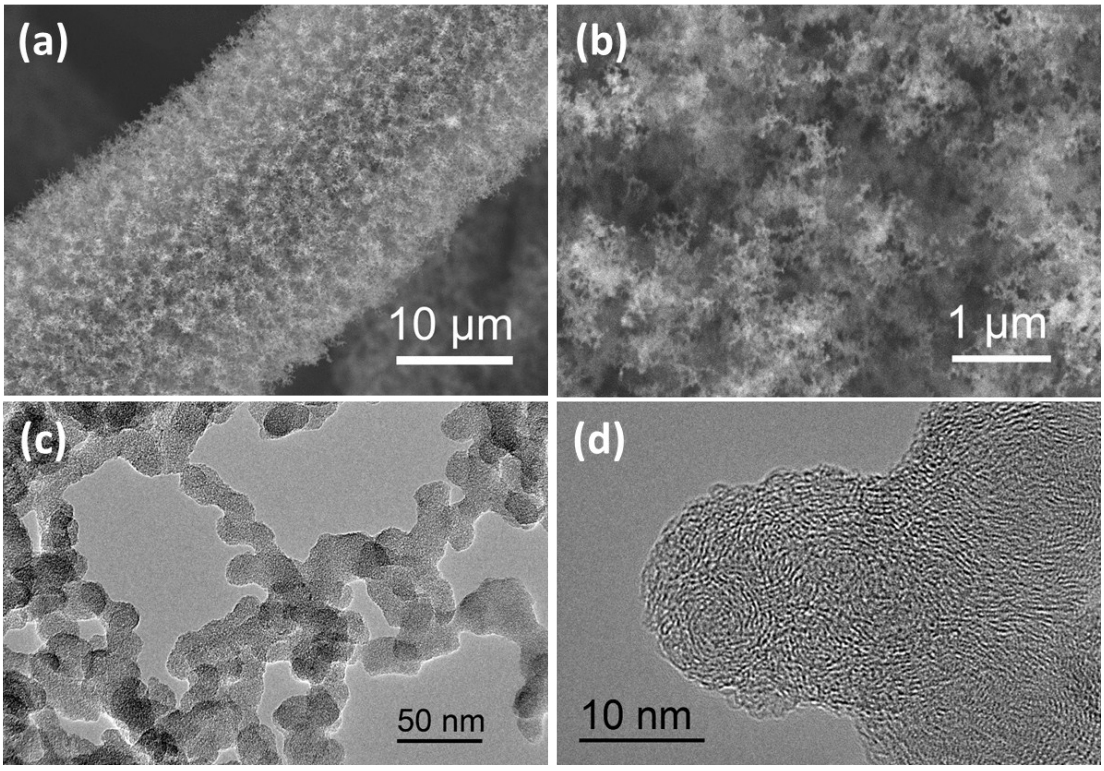

Figure S2. (a) SEM image of a CNPs coated carbon fiber electrode. (b) High resolution SEM image showing the morphology of the CF@CNPs electrode. (c) TEM image of CNP. (d) High resolution TEM image of CNP.

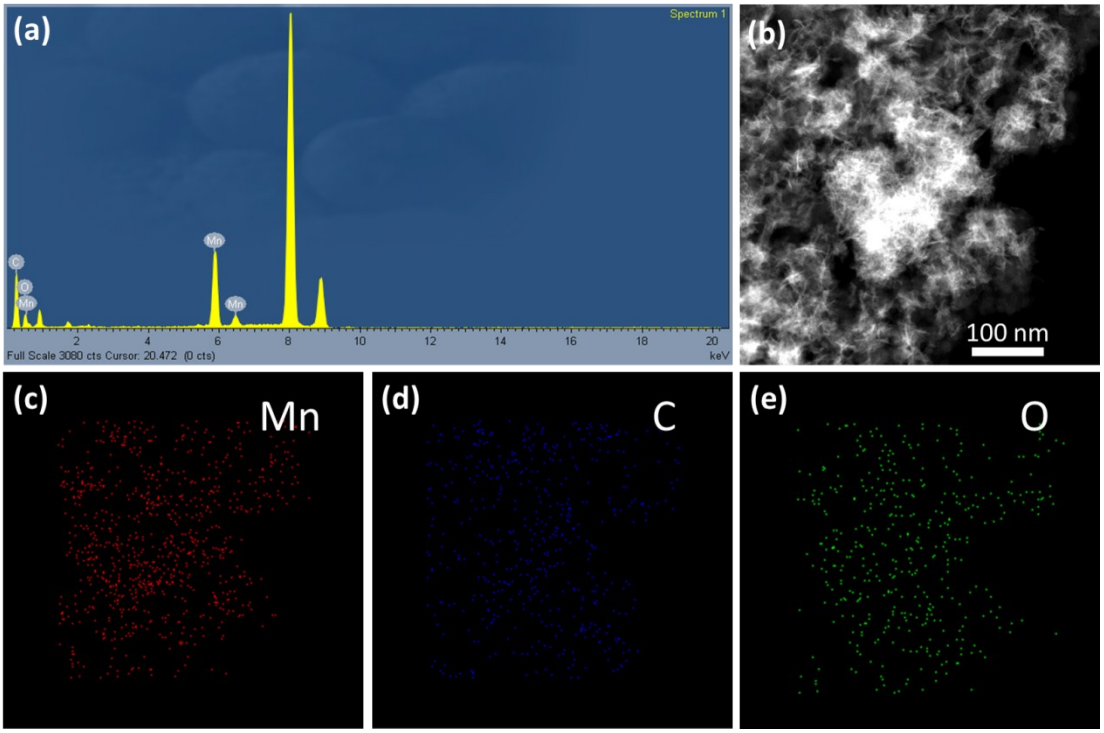

Figure S3. (a) EDS spectrum of MnO_2 and CNP composite. (b) STEM images of MnO_2 and CNP composite. (c), (d) and (e) Mn, C and O element mapping, corresponding to the area of (b).

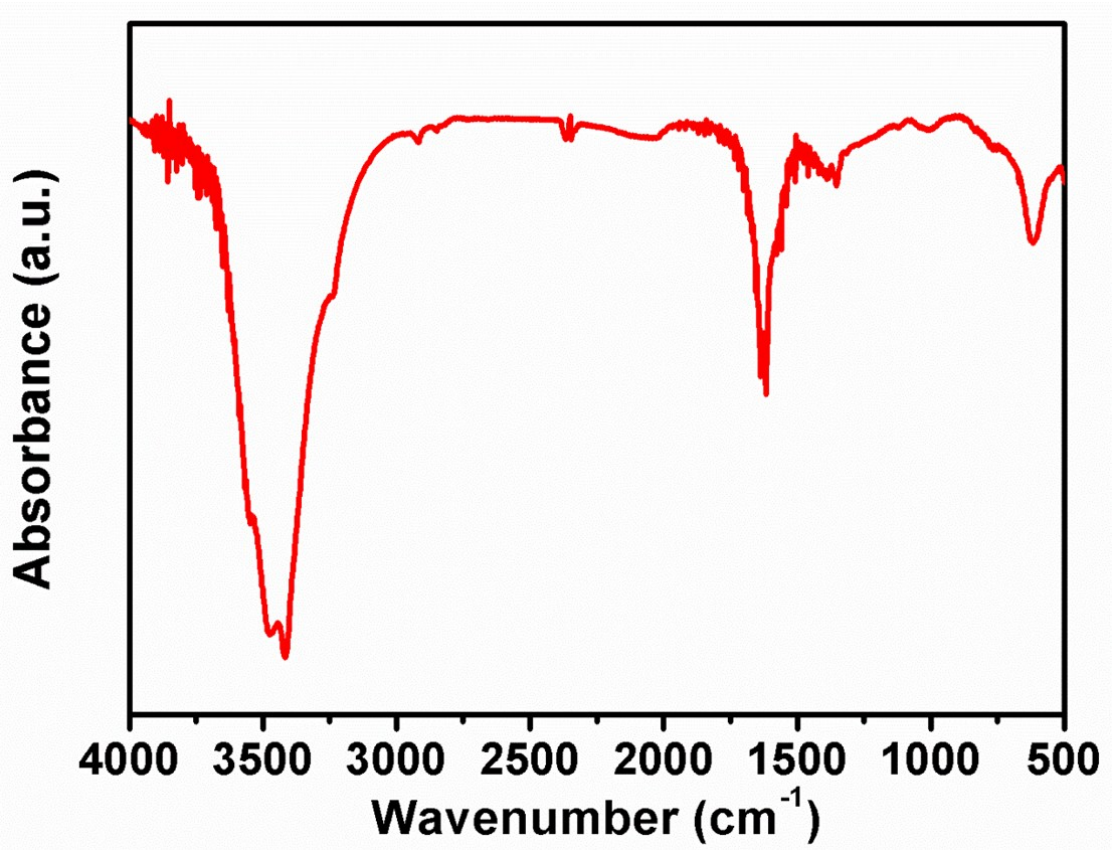

Figure S4. FTIR spectrum of the FCNP electrode.

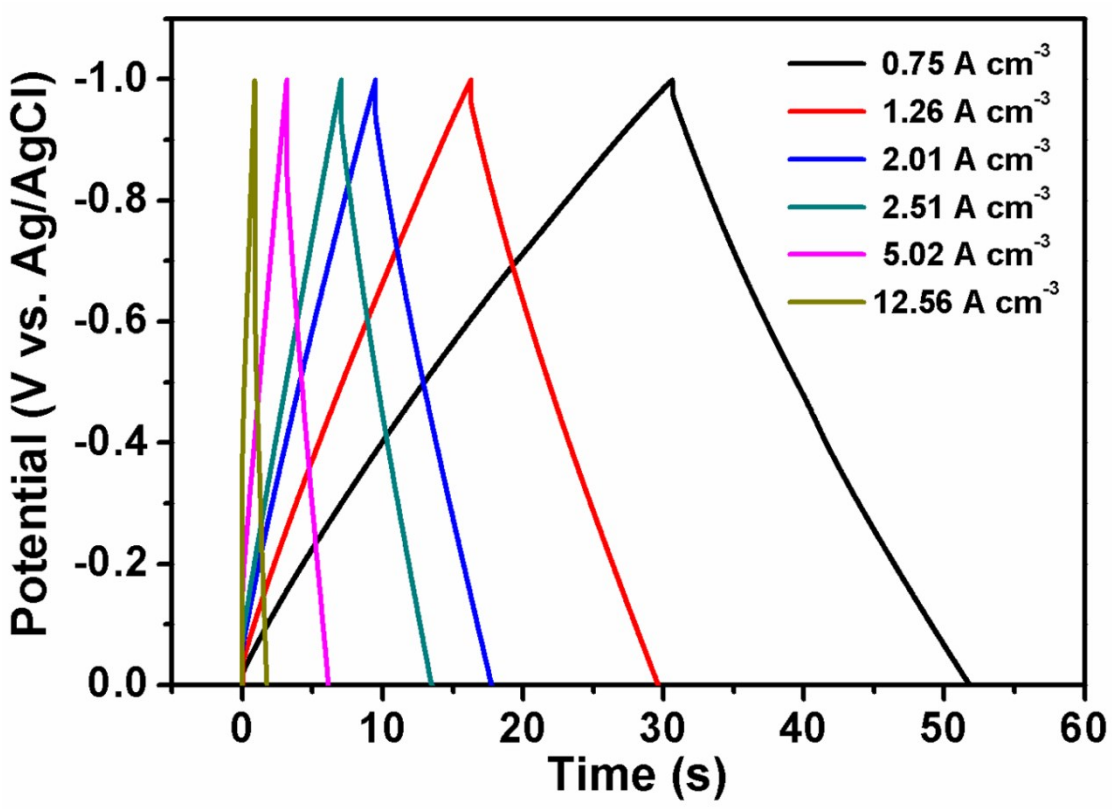

Figure S5. GCD curves of FCNP electrode at different current densities.

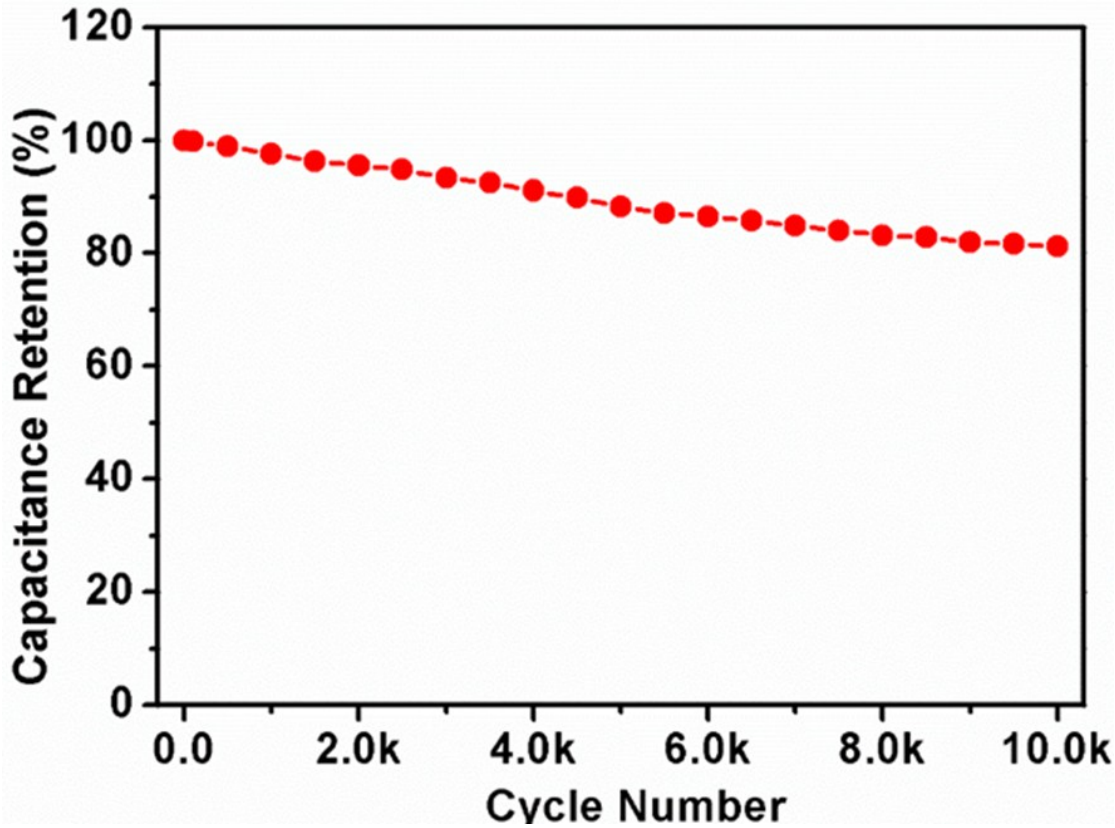

Figure S6. Cycle performance of the solid-state ASC device at a scan rate of 500 mV s^{-1} for 10 000 cycles.

Ref	Device Form	Energy density (mWh cm^{-3})	Power density (W cm^{-3})	Electrolyte
6	Planar	1	1000	Et_4NBF_4
8	Planar	0.6	200	PVA/H_2SO_4
14	Fiber	0.22	0.4	PVA/H_3PO_4
15	Fiber	5	0.93	PVP/Na_2SO_4
18	Fiber	1.4	40	PVA/H_3PO_4
41	Planar	1.75	3.44	PVA/H_2SO_4
42	Planar	2.5	495	PVA/H_2SO_4
Our work	Fiber	2.1	8	PVA/LiCl

Table S1. Performance summary and comparison of different SC devices.