Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Advanced solid-state asymmetric supercapacitors based on 3D graphene/MnO_2 and graphene/polypyrrole hybrid architectures

Zheye Zhang, Kai Chi, Fei Xiao* and Shuai Wang*

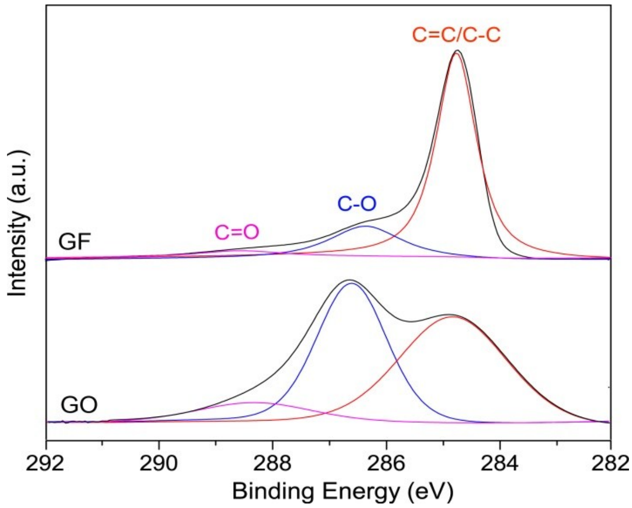

Fig. S1 The C 1s spectra of GF and GO.

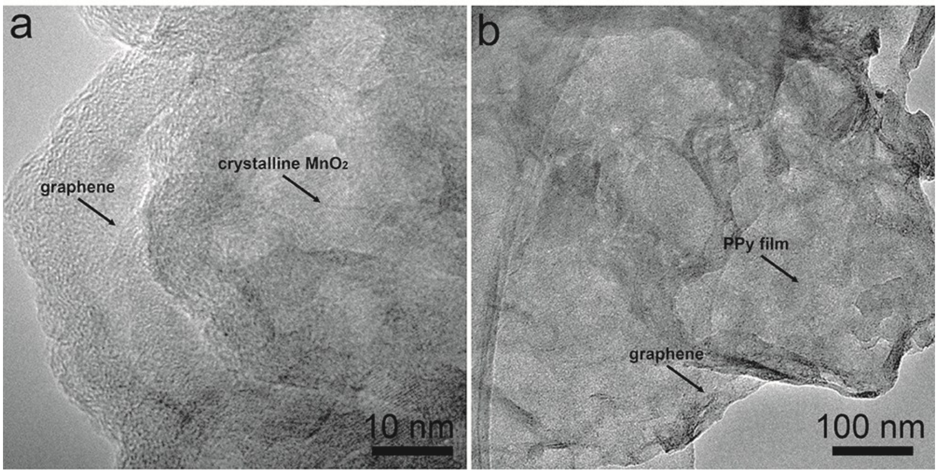

Fig. S2 TEM images of (a) Ni/GF/MnO_2 and (b) Ni/GF/PPy.

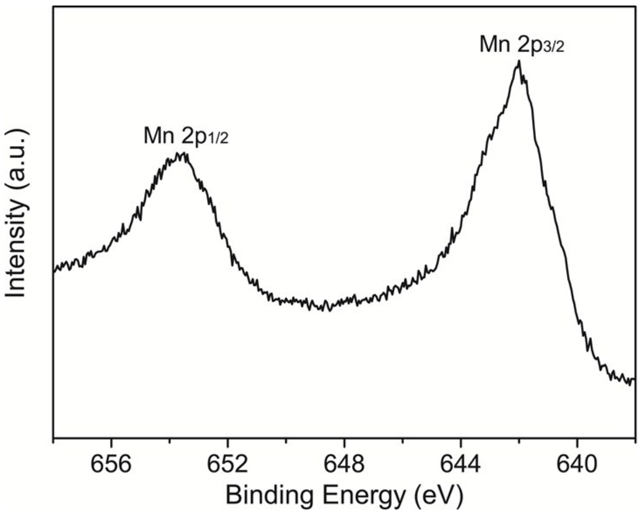

Fig. S3 Curve fit of Mn 2p spectra of Ni/GF/MnO_2 hybrid architecture.

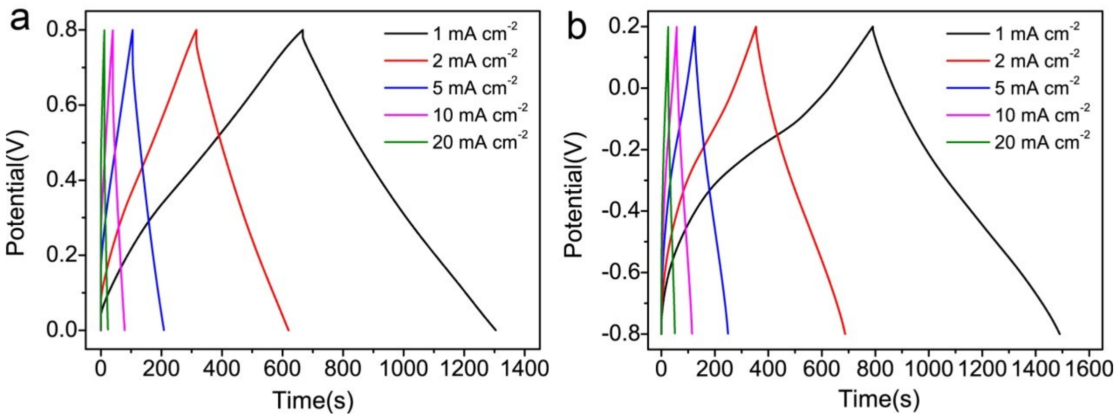

Fig. S4 Galvanostatic charge/discharge curves of (a) Ni/GF/MnO_2 electrode and (b) Ni/GF/PPy electrode at different current densities.

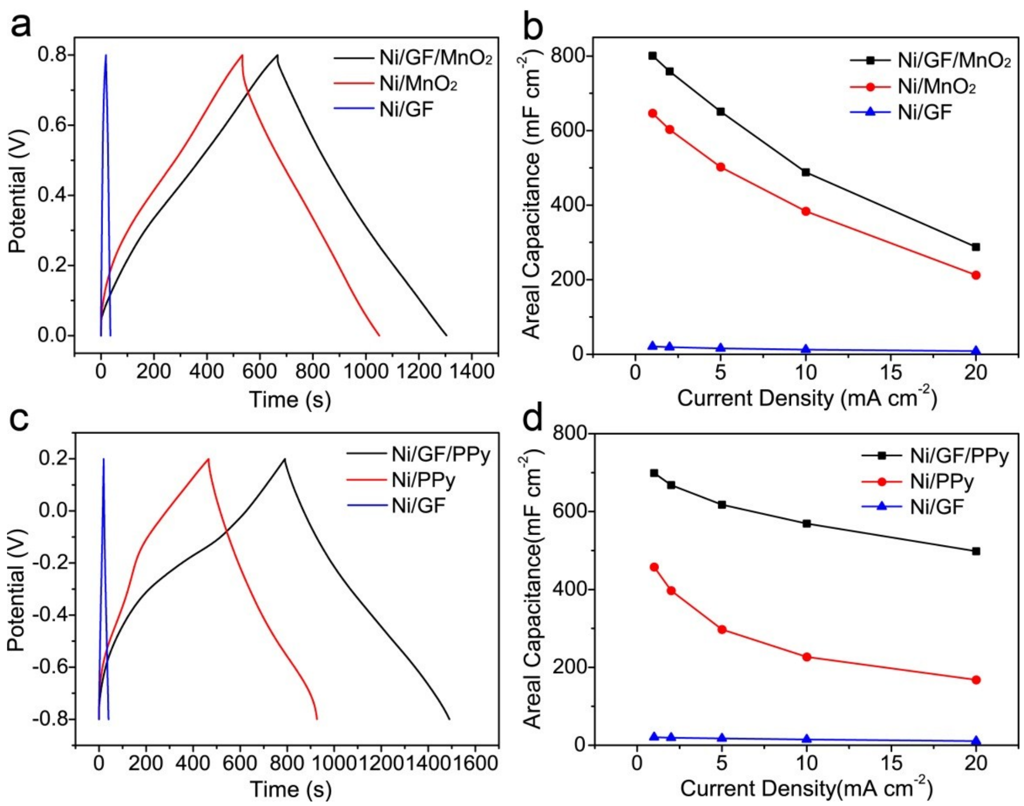

Fig. S5 Galvanostatic charge/discharge curves of (a) Ni/GF, Ni/MnO_2 and Ni/GF/MnO_2 electrodes and (c) Ni/GF, Ni/PPy and Ni/GF/PPy electrodes at a current density of 1 mA cm^{-2}. Dependence of areal capacitance on the charge/discharge current density for (b) Ni/GF, Ni/MnO_2 and Ni/GF/MnO_2 electrodes and (d) Ni/GF, Ni/PPy and Ni/GF/PPy electrodes.

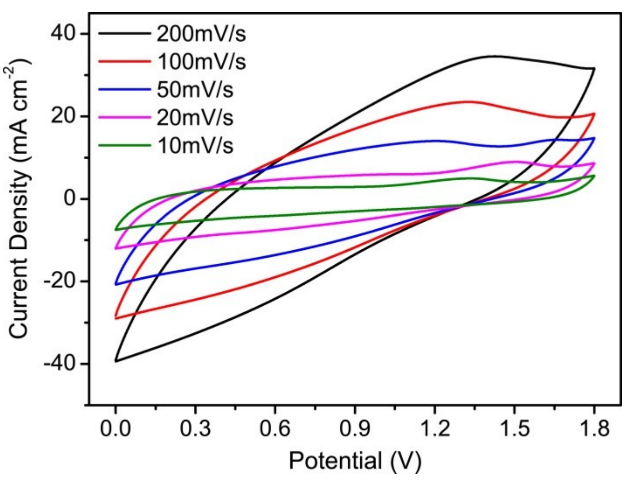

Fig. S6 CV curves of the asymmetric supercapacitor device collected at different scan rates.

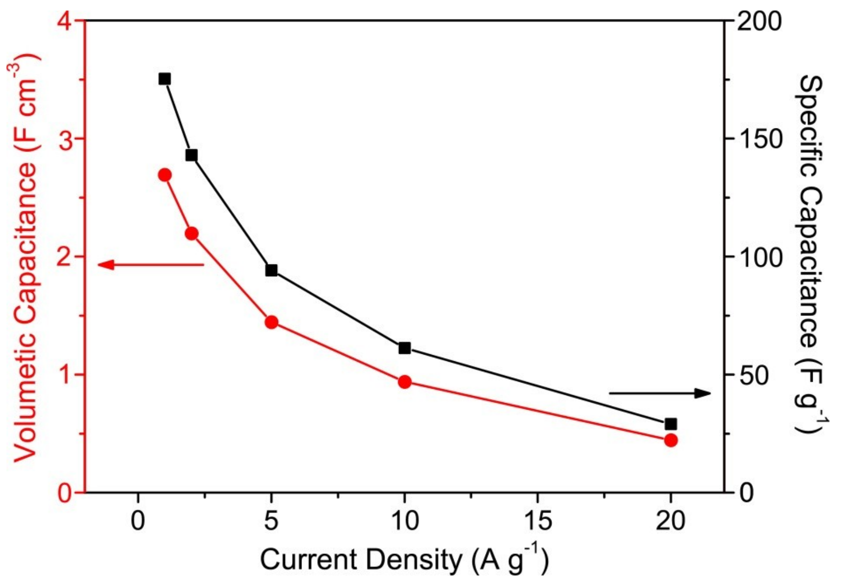

Fig. S7 Volumetric and specific capacitance calculated from the charge/discharge curves as a function of current density for the asymmetric supercapacitor device.

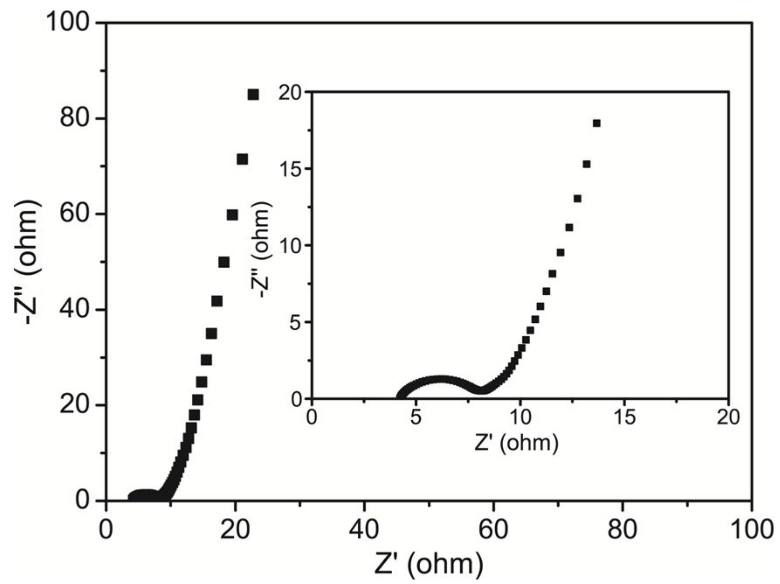

Fig. S8 Nyquist plots of the asymmetric supercapacitor device. The inset is the enlarged Nyquist plot from the high-frequency region.

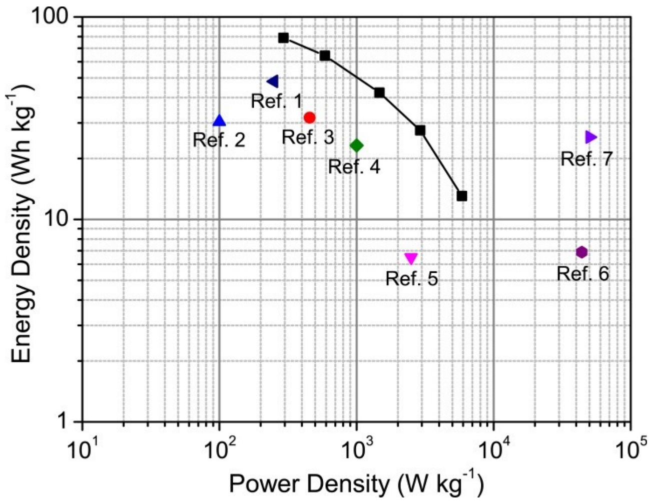

Fig. S9 Ragone plot of the device and some other devices from previous literature for comparison.

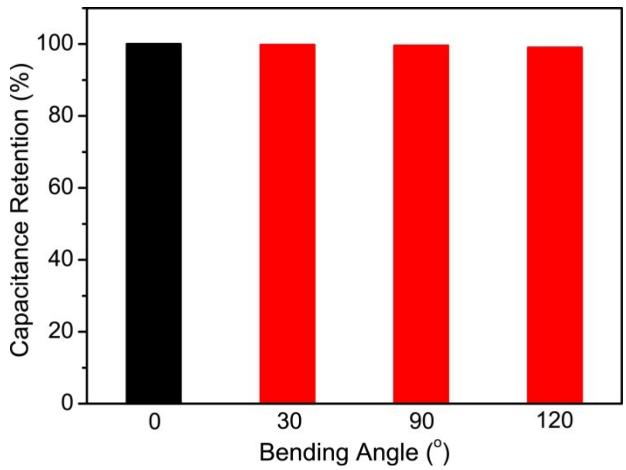

Fig. S10 Capacitance retention after bending inward to different angles.

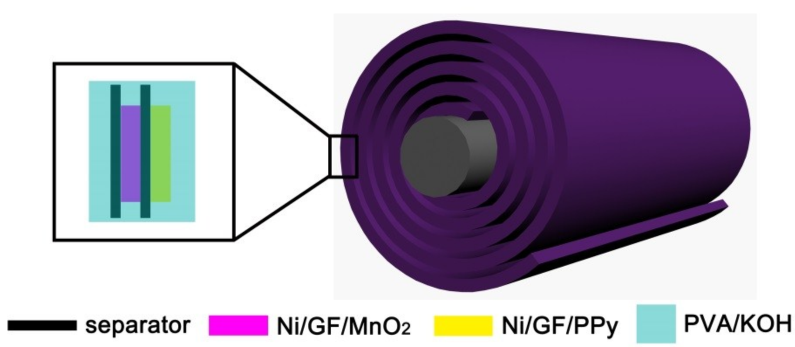

Fig. S11 Schematic illustration of a winding type solid-state asymmetric supercapacitor.

[1] H. Wang, Y. Liang, T. Mirfakhrai, Z. Chen, H. S. Casalongue, H. J. Dai, Nano Res. 4 (2011) 729.

[2] Z. S. Wu, W. C. Ren, D. W. Wang, F. Li, B. L. Liu, H. M. Cheng, ACS Nano 4 (2010) 5835.

[3] Z. Y. Zhang, F. Xiao, L. H. Qian, J. W. Xiao, S. Wang, Y. Q. Liu, Adv. Energ. Mater. 4 (2014) 10.1002/aenm.201400064.

[4] H. C. Gao, F. Xiao, C. B. Ching, H. W. Duan, ACS Appl. Mater. Interfaces 4 (2012) 2801.

[5] T. Y. Kim, H. W. Lee, M. Stoller, D. R. Dreyer, C. W. Bielawski, R. S. Ruoff, K. S. Suh, ACS Nano 5 (2011) 436.

[6] J. Y. Ji, L. L. Zhang, H. X. Ji, Y. Li, X. Zhao, X. Bai, X. B. Fan, F. B. Zhang, R. S. Ruoff, ACS Nano 7 (2013) 6237.

[7] P. C. Chen, G. Z. Shen, Y. Shi, H. T. Chen, C. W. Zhou, ACS Nano 4 (2010) 4403.