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

Supporting Information

Free-Standing Composite Hydrogel Film for Superior Volumetric Capacitance

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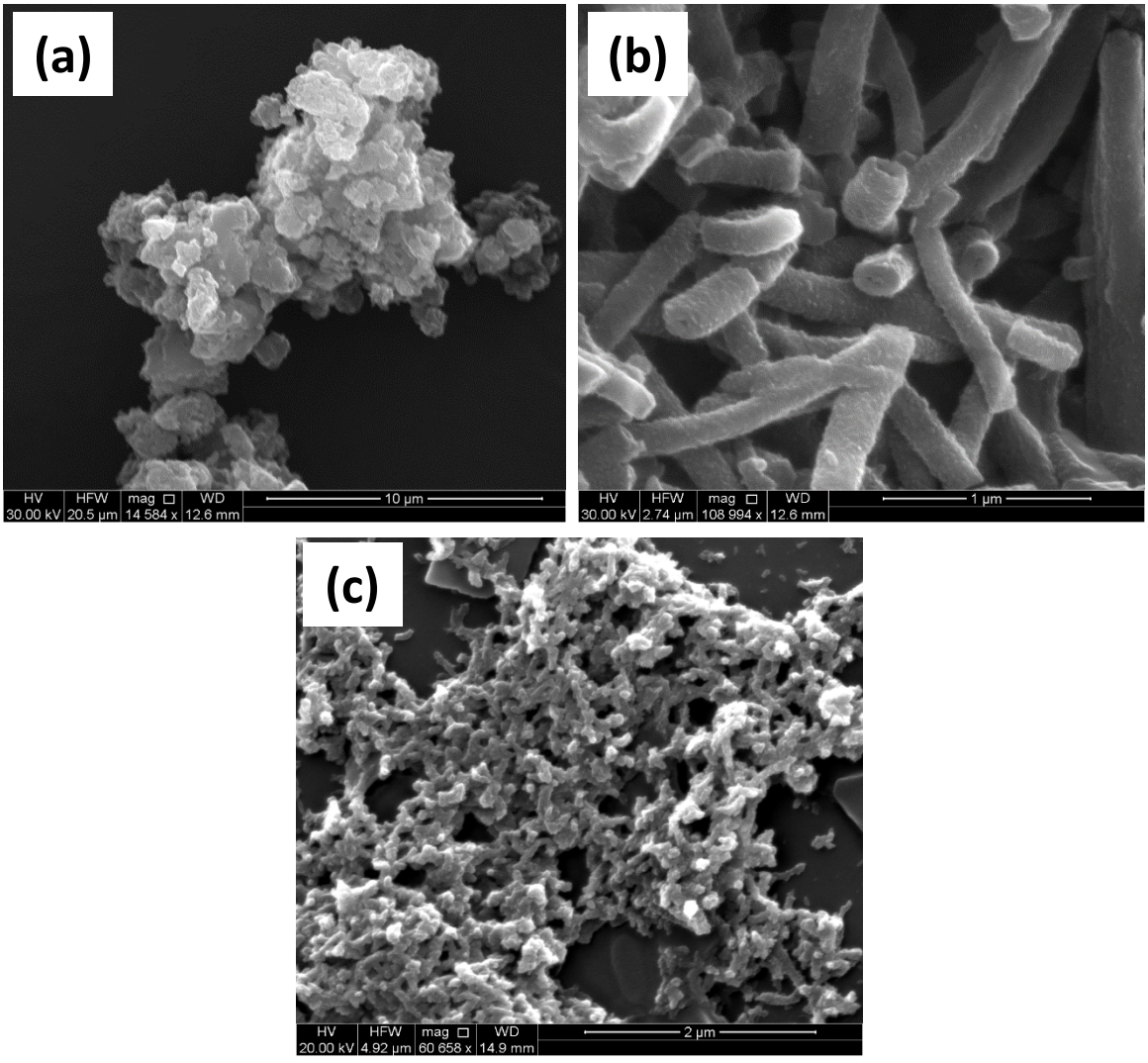

Fig. S1. SEM images of (a) a composite of polyaniline and poly (2-acrylamido-2-methyl-1-propanesulfonic acid (denoted PANi-PAMPA), (b) PANi-nanotubes and (c) PANi-nanofibers.

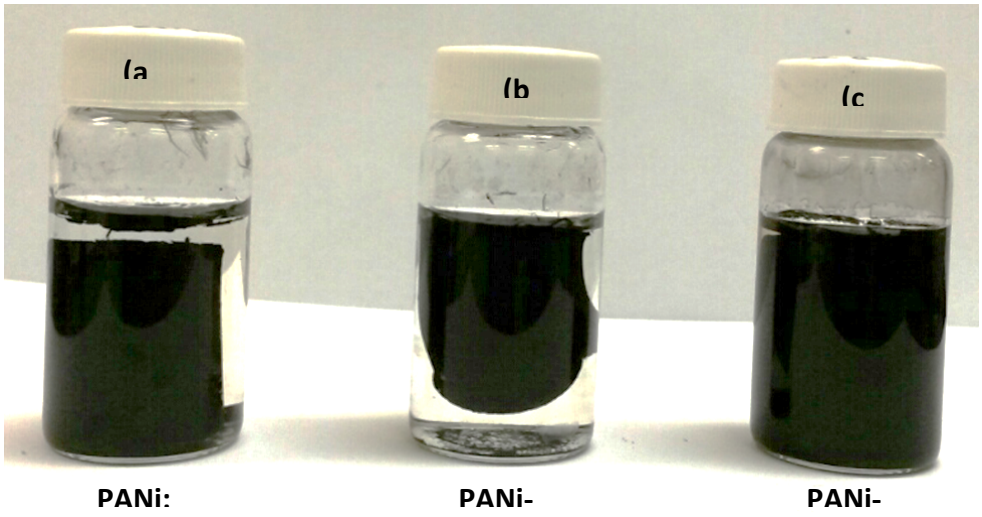

Figure S2. Photos of polyaniline/graphene hydrogel (PANi/ graphene hydrogel) in presence of (a) PANi- PAMPA, (b) PANi-nanotubes and (c) PANi-nanofibers.

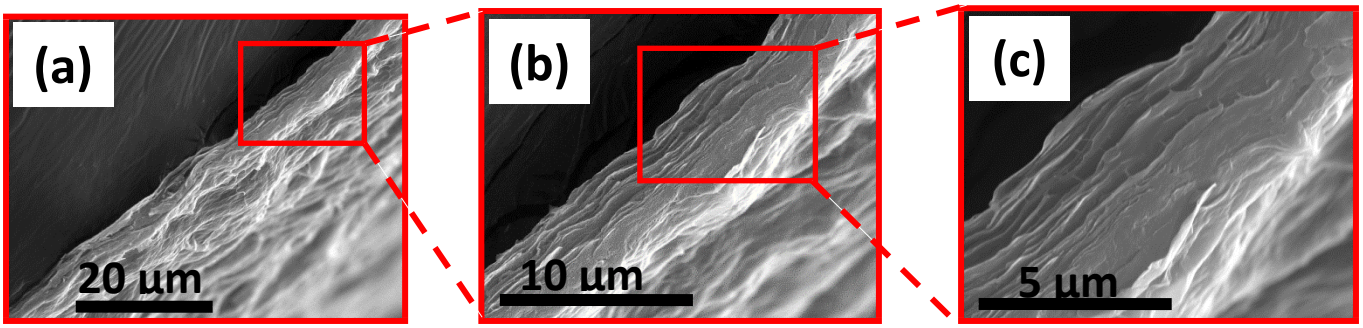

Figure S3. SEM of free-standing PANi/graphene hydrogel film illustrates its layer structure at different magnifications.

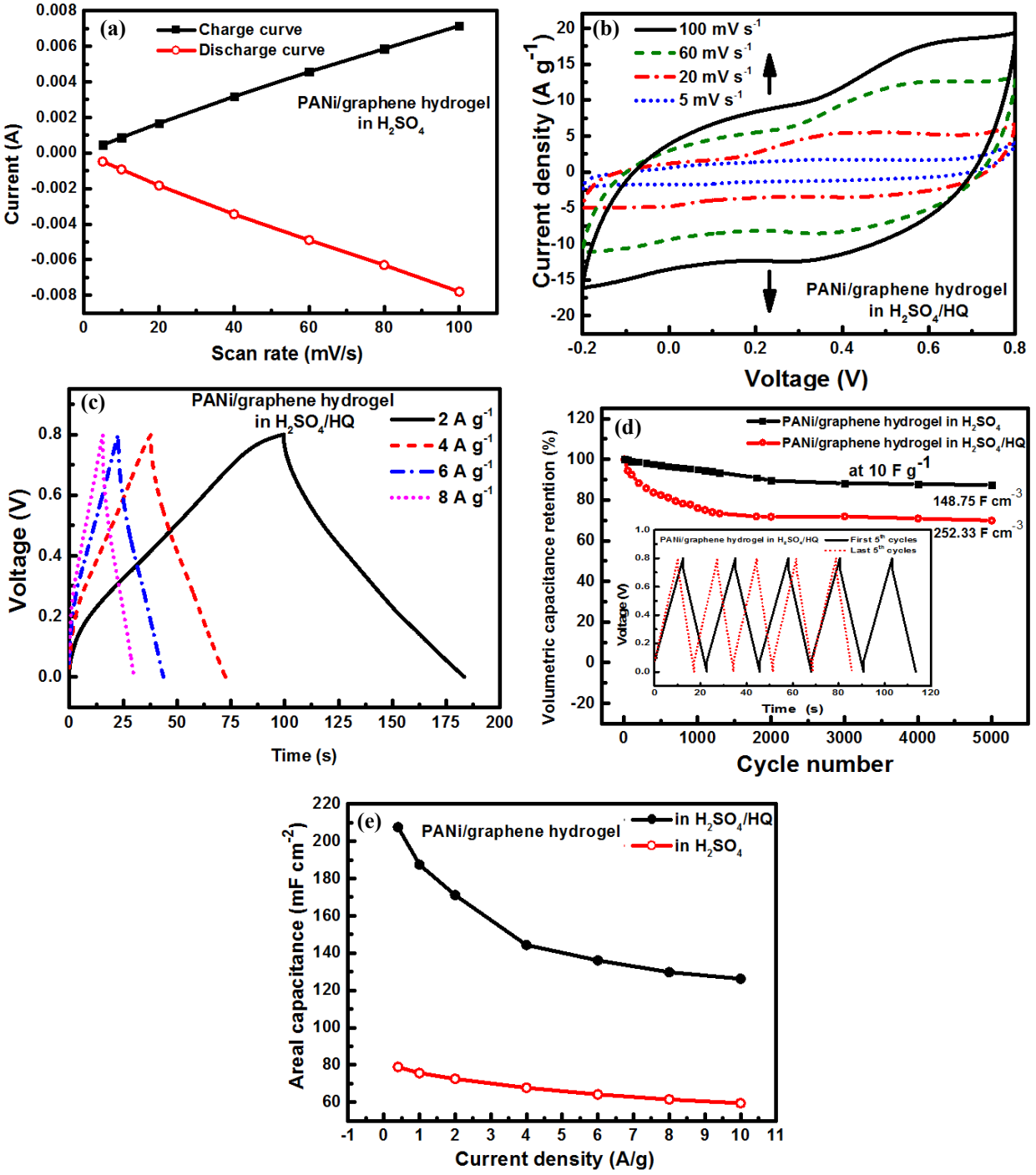

Figure S4. Electrochemical performance of PANi/graphene hydrogel electrodes in H_2SO_4/HQ: (b) correlation between current and scan rate in H_2SO_4, (a) Cyclic votammograms (CVs) at different scan rates in H_2SO_4/HQ, (b) The charge/discharge curves (CDs) at different current densities in H_2SO_4/HQ, (c) cycling performance in H_2SO_4/HQ, and (e) the areal capacitances at different current densities.

Table S1. Reported gravimetric and volumetric capacitances of some graphene materials.

Materials	Electrolyte	ρ (g/cm^3)	Electrode configuration	C_{wt} (F/g)	C_{vol} (F/cm^3)	Ref.
PANi/graphene hydrogel	1 M H_2SO_4	1.02	Two	223.82	228.30	This work
PANi/graphene hydrogel	(1 M H_2SO_4/0.4 M HQ)	1.02	Two	580.52 (0.4 A/g)	592.96 (0.4 A/g)	This work
High density porous graphene	6 M KOH	1.58	Two	238.00	376.00	[2]
Carbon nanotubes-graphene fibres	PVA/H_3PO_4	0.59	Two	-	300.00 (26.7 mA/cm^3)	[3]
Compact reduced graphene gel	1 M H_2SO_4	1.25	Two	191.70 (0.1 A/g)	255.5 (0.1 A/g)	[1]
Holey graphene frameworks	1 M H_2SO_4	0.71	Two	310.00 (1 A/g)	220.10* (1 A/g)	[4]
Porous carbon layer/graphene	6 M KOH	-	Three	481.00 (0.5 A/g)	212.00 (0.5 A/g)	[5]
Graphene hydrogel	1 M H_2SO_4	0.05	Three	258.00 (0.3 A/g)	12.9* (0.3 A/g)	[6]
Oriented graphene hydrogel	1 M H_2SO_4	0.069	Two	215.00 (0.1 A/g)	14.8* (0.1 A/g)	[7]
Graphene hydrogel film	1 M H_2SO_4	0.167	Two	190.00 (1 A/g)	31.67* (1 A/g)	[8]
Functionalized graphene hydrogel film	1 M H_2SO_4	-	Two	441.00 (1 A/g)	-	[9]
Self-assembled graphene hydrogel	5 M KOH	-	Two	160.00 (1 A/g)	-	[10]

* The volumetric capacitance (C_{vol}) = gravimetric capacitance (C_{wt}) × Packing density (ρ) [1].

References

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