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

All Conducting Polymer Electrodes for Asymmetric Solid-State Supercapacitors

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Electronic Supplementary Information (ESI)

Specific areal capacitance (C_A) and cell capacitance (C_{cell}) were calculated from the charge-discharge curves according to the following equations.

Specific areal capacitance (mF/cm^2) was calculated by dividing the single PEDOT electrode capacitance by area.

Specific areal capacitance (C_A) = $(i/A_{single})(\Delta t/\Delta E)$ (for 3-electrode configuration).

A_{single} is the area of single electrode, i is the current applied, Δt is the discharge time and ΔE is the potential window.

Cell capacitance (C_{cell}) = $(i/A_{two})(\Delta t/\Delta V)$ (for 2-electrode configuration).

A_{two} is the total area of both the electrodes.

Volumetric stack capacitance (F/cm^3) was calculated by considering the total volume of the both the electrodes.

Volumetric stack capacitance (C_{vol}) = $(i/v_t)(\Delta t/\Delta V)$

Energy density (E) = $\frac{1}{2}C_{vol}V^2$ (in Wh/cm^3)

Power density (P) = E/Δt (in W/cm^3).

Where i is the discharge current density, A_{single} and A_{two} are the areas of the single and two electrodes in cm^2 respectively, C_{cell} is the cell capacitance, C_{vol} is the volumetric stack capacitance, v_t is the total volume of the electrodes.

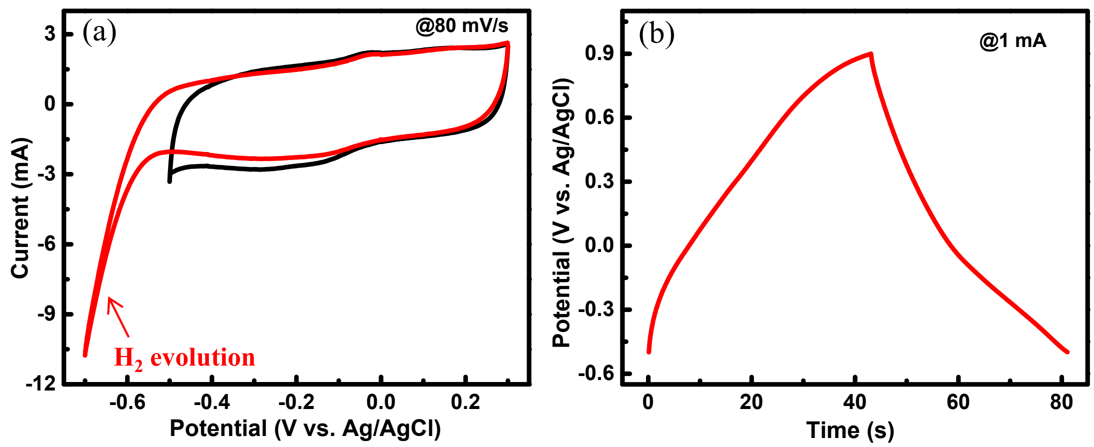

Fig. S1 (a) CVs of PEDOT in different negative potential windows. (b) Charge-discharge curve for the PEDOT in a wide potential window of 1.4 V.

The sharp rise in the current below -0.6 V is due to hydrogen evolution reaction (see red curve in Figure S1a).

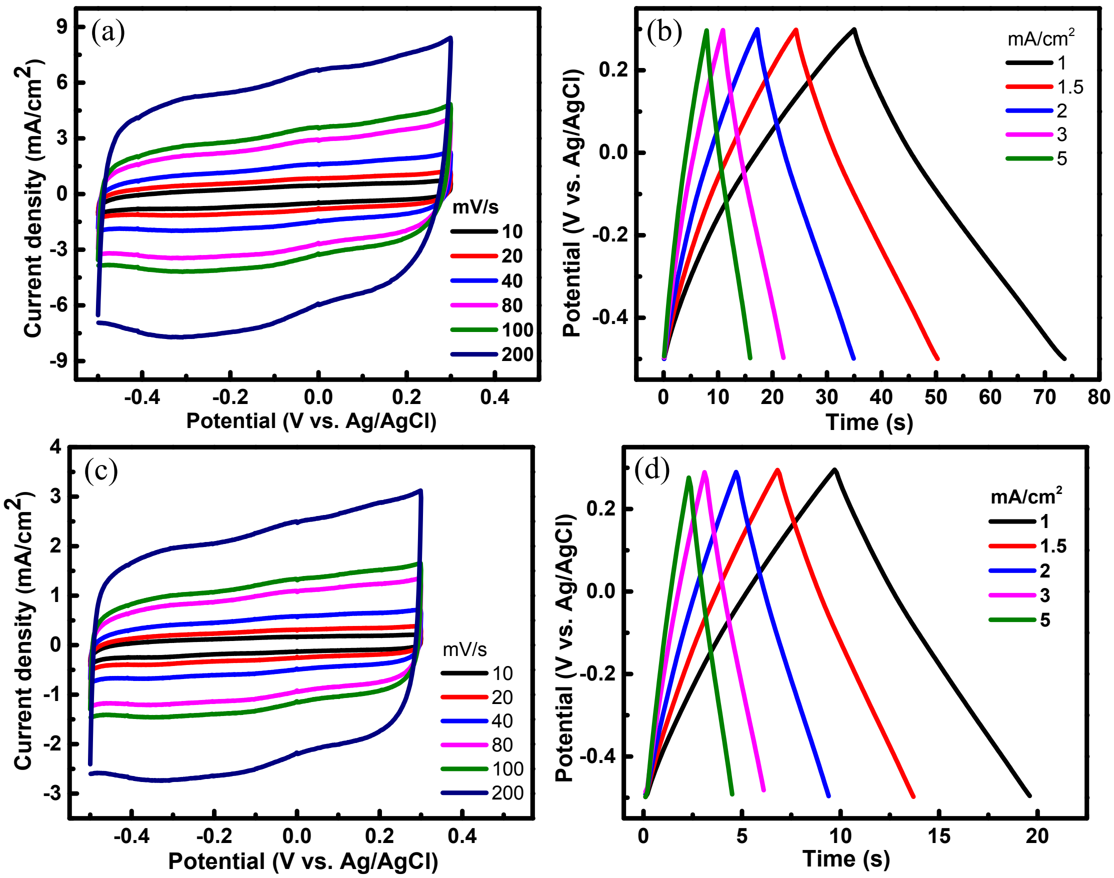

Fig. S2 (a) and (b) CV and CD of 5 minute deposited PEDOT sample. (c) CV and (d) CD of 15 minute deposited PEDOT sample.

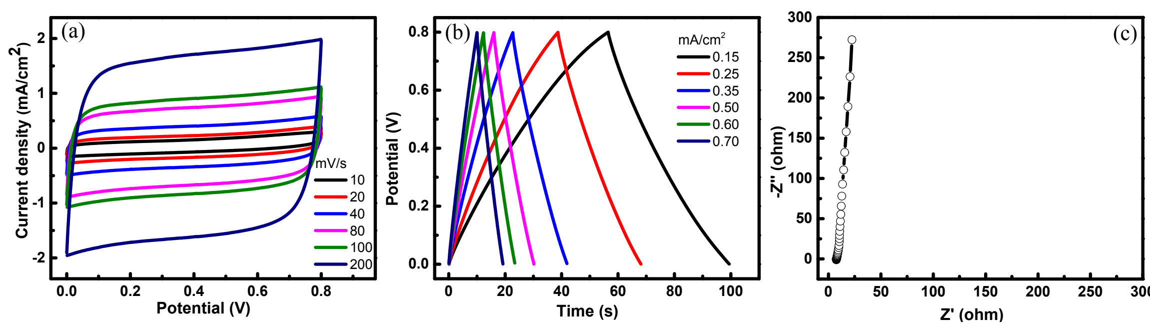

Fig. S3 (a) CV and (b) CDs of symmetric PEDOT/Au/PEN//PEDOT/Au/PEN solid state device using PVA/H_2SO_4 gel electrolyte. (c) Nyquist plot for the symmetric PEDOT solid state device.

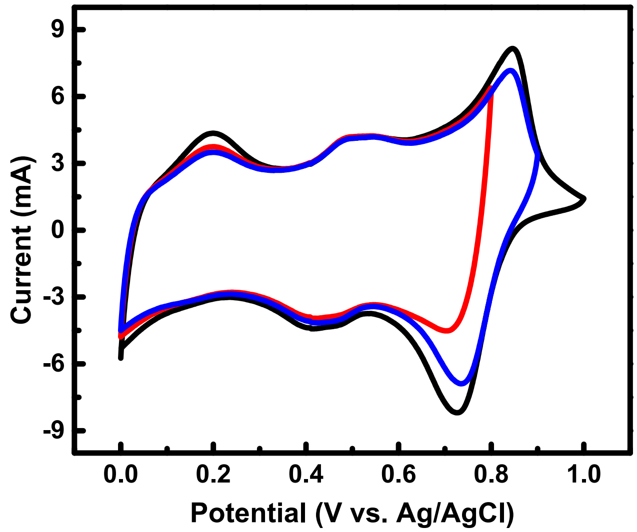

Fig. S4 CVs of PANI in different positive potential windows at a scan rate of 80 mV/s. CV is getting narrow down above the potential of 0.8 V.

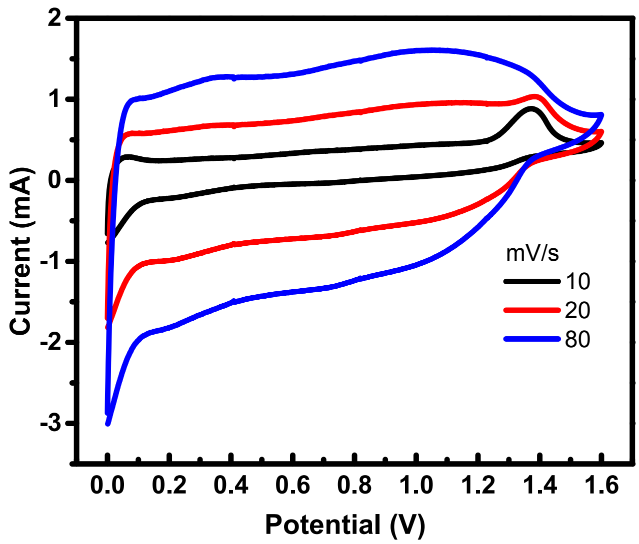

Fig. S5 Unoptimised CVS of the PANI//PEDOT ASC.

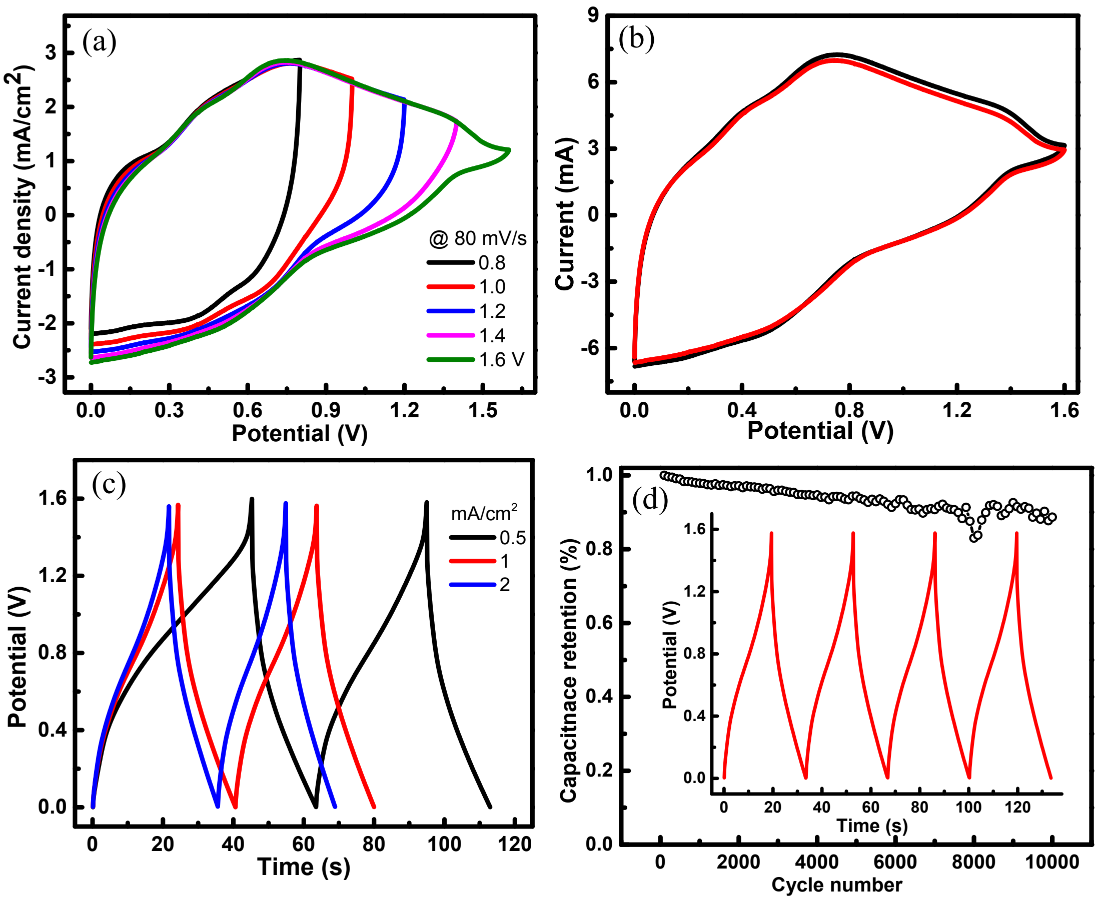

Fig. S6 (a) CVs of ASC device at a scan rate of 80 mV/s in different potential windows. (b) CV scans at a scan rate of 80 mV/s and (c) CDs of ASC device at different current densities after 100 cycles of charging and discharging. (d) Cycling stability of the optimized PANI//PEDOT ASC solid state supercapacitor over 10,000 cycles. Inset shows the charge-discharge curves at a current density of 2 mA/cm^2.

Table S1. Comparison of the electrochemical performance of the ASCs reported in the literature.

S. No.	ASC	Electrolyte	Potential window	Energy density (mWh/cm^3)	Power density (W/cm^3)	References
1.	VO_x//VN	PVA/LiCl	1.8	0.61	0.85	Lu et al., Nano Lett. 2013, 13, 2628−2633
2.	PANI//MoO_3/WO_3	PVA/H_3PO_4	1.9	1.9	0.73	Xiao et al., Adv. Energy Mater. 2012, 2, 1328–1332
3.	MnO_2 NWs//Fe_2O_3 NTs	PVA/KCl	1.6	0.55	0.139	Yang et al., Nano Lett. 2014, 14, 731−736.
4.	Co_9S_8 // Co_3O_4@RuO_2	PVA/KOH	1.6	1.44	0.89	Xu et al., ACS Nano, 2013, 7, 5453–5462
5.	PANI//PEDOT	PVA/H_2SO_4	1.6	9	2.8	This work