Supporting Information

Amphiphilic Block-Graft Copolymer Electrolyte: Synthesis, Nanostructure, and Use in Solid-state Flexible Supercapacitors

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Calculation of Flory–Huggins interaction parameter (χ)

The χ values of PS-toluene, PS-chloroform, PB-toluene, and PB-chloroform pairs are available from literature (Adv. Funct. Mater. 2012, 22, 1759–1767; *Journal of Polymer Science: Polymer Physics Edition* **1983,** *21*, 1993–2001).

However, the χ values of POEM-toluene and POEM-chloroform are not available. They were predicted using the equation below.

$$\chi_{PS} = \frac{V_s(\delta_S - \delta_P)^2}{RT} + 0.34$$

where:

χ_{PS} is the Flory–Huggins interaction parameter between the polymer and the solvent,

R is the gas constant = 8.31 J/K mol,

T is the temperature = 298 K (25 °C),

V_s is the molar volume of the solvent: toluene (106.8 ml/mol) and chloroform (80.7 ml/mol),

δ_S is the solubility parameter of the solvent: toluene (18.2 $J^{1/2}cm^{-2/3}$) and chloroform (19.0 $J^{1/2}cm^{-2/3}$), and

δ_P of POEM is approximately 19.8 $J^{1/2}cm^{-2/3}$.

Thus,

$\chi_{POEM\text{-}toluene}$ = 106.8 × (18.2–19.8)^2/8.31 × 298 + 0.34 = 0.4245.

and

$\chi_{POEM\text{-}chloroform}$ = 80.7 × (19.0–19.8)^2/8.31 × 298 + 0.34 = 0.3608.

Figure S1. NMR spectra of SBS-g-POEM(500) and SBS-g-POEM(950).

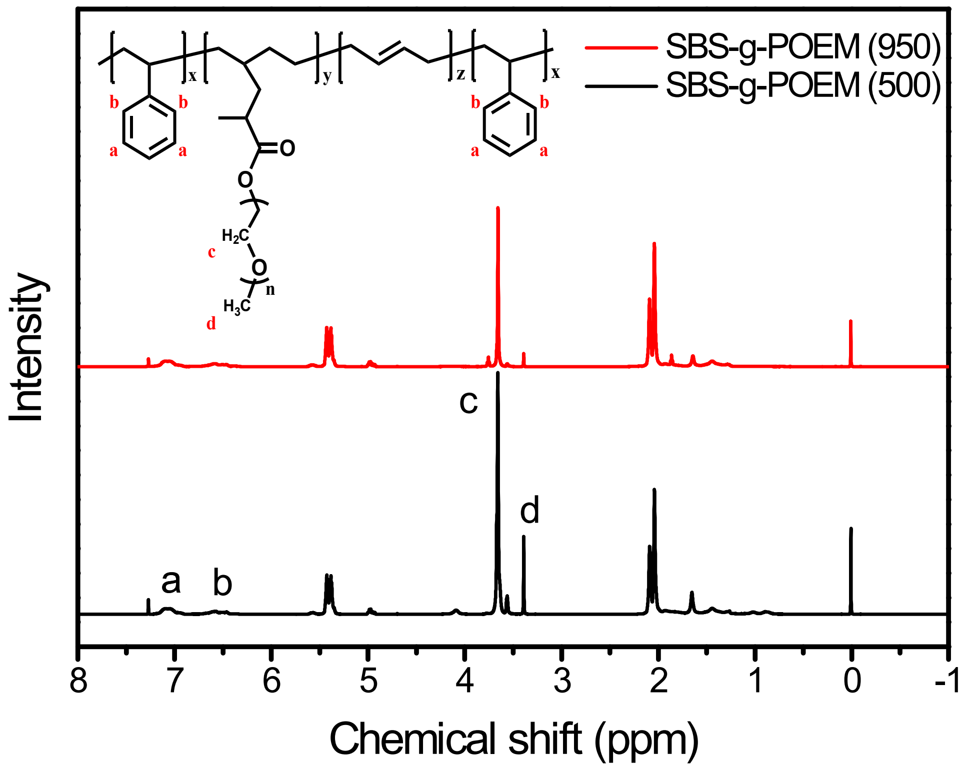

Figure S2. Ionic conductivity of SBS-g-POEM block-graft copolymer electrolyte with different ratios of SBS to POEM at 25 °C. The LiTFSI concentration was fixed at 1.7% and PC was not added.

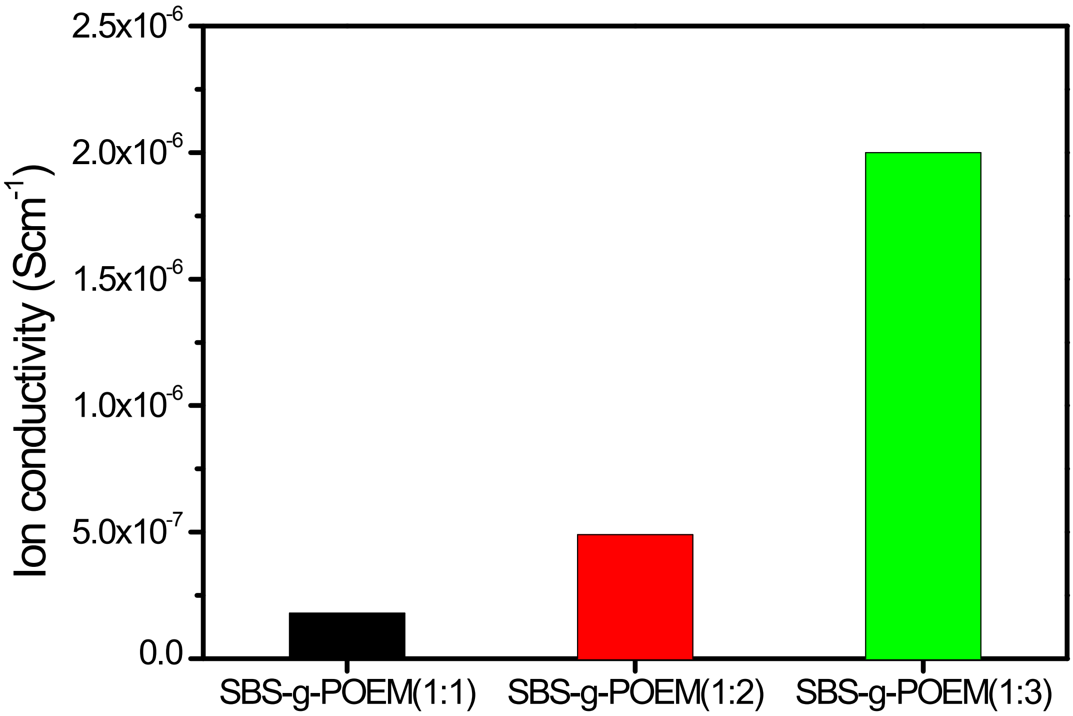

Figure S3. UTM curves of neat SBS and SBS-g-POEM (1:3) block-graft copolymer.

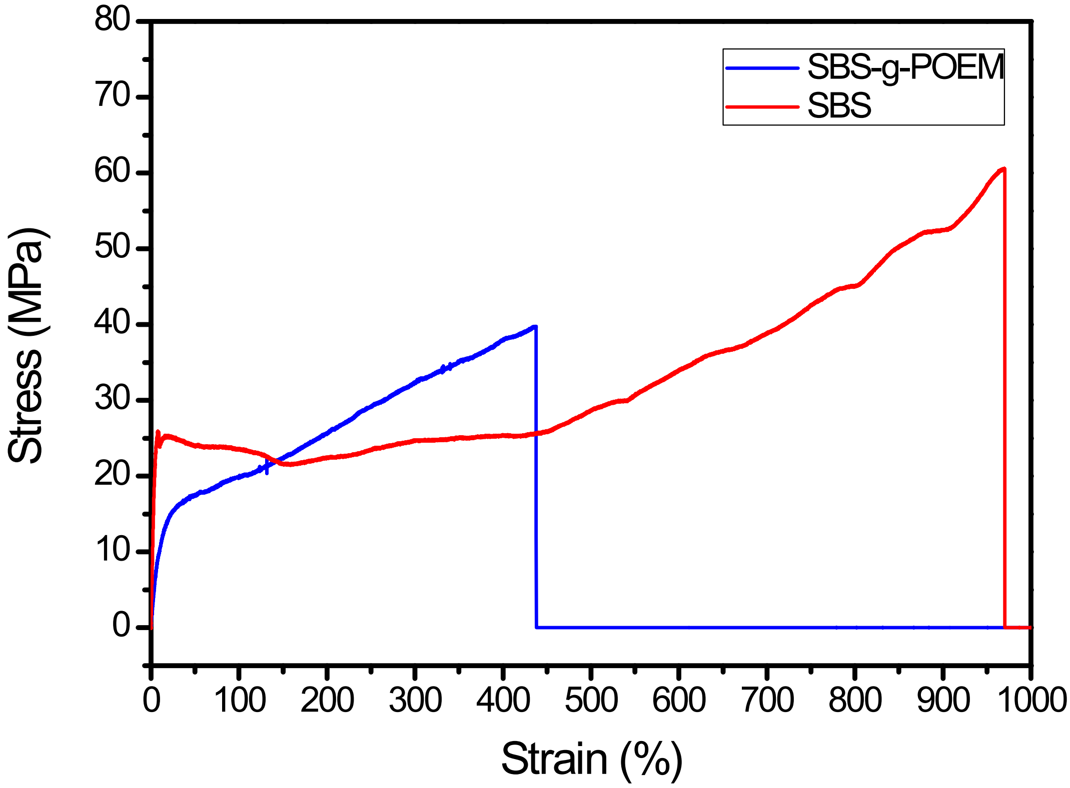

Figure S4. Ionic conductivity of SBS-g-POEM block-graft copolymer electrolyte with different POEM chain lengths at 25 °C. The LiTFSI concentration was fixed at 1.7 % while PC was not added.

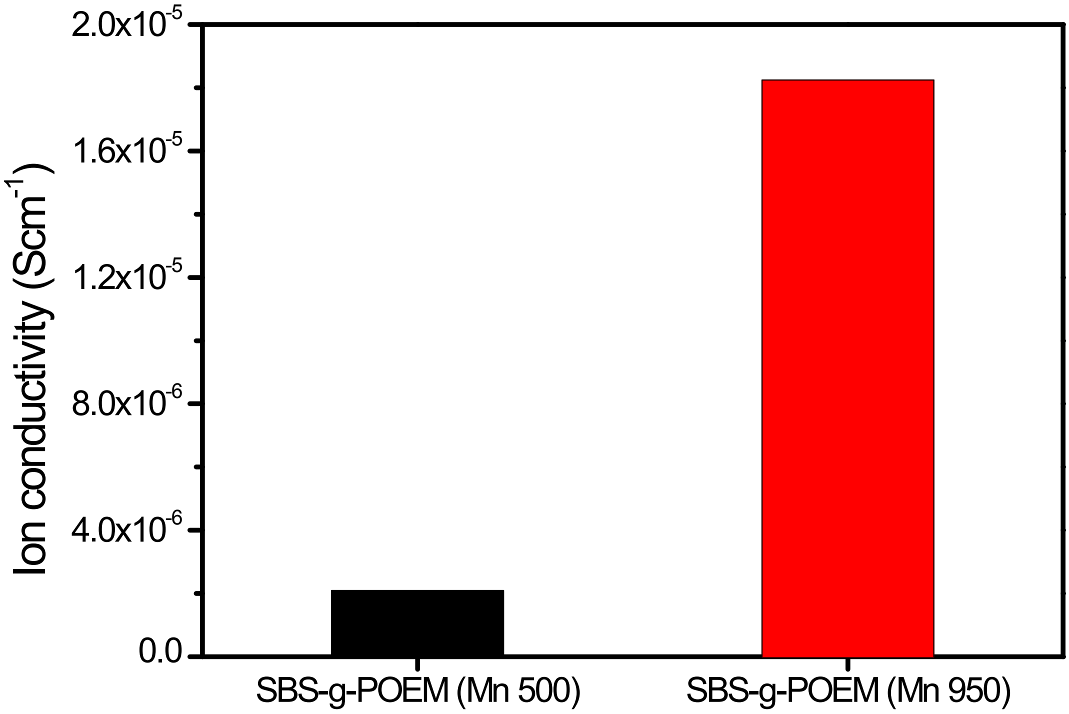

Figure S5. Ionic conductivity of SBS-g-POEM block-graft copolymer electrolyte with different PC concentrations at 25 °C.

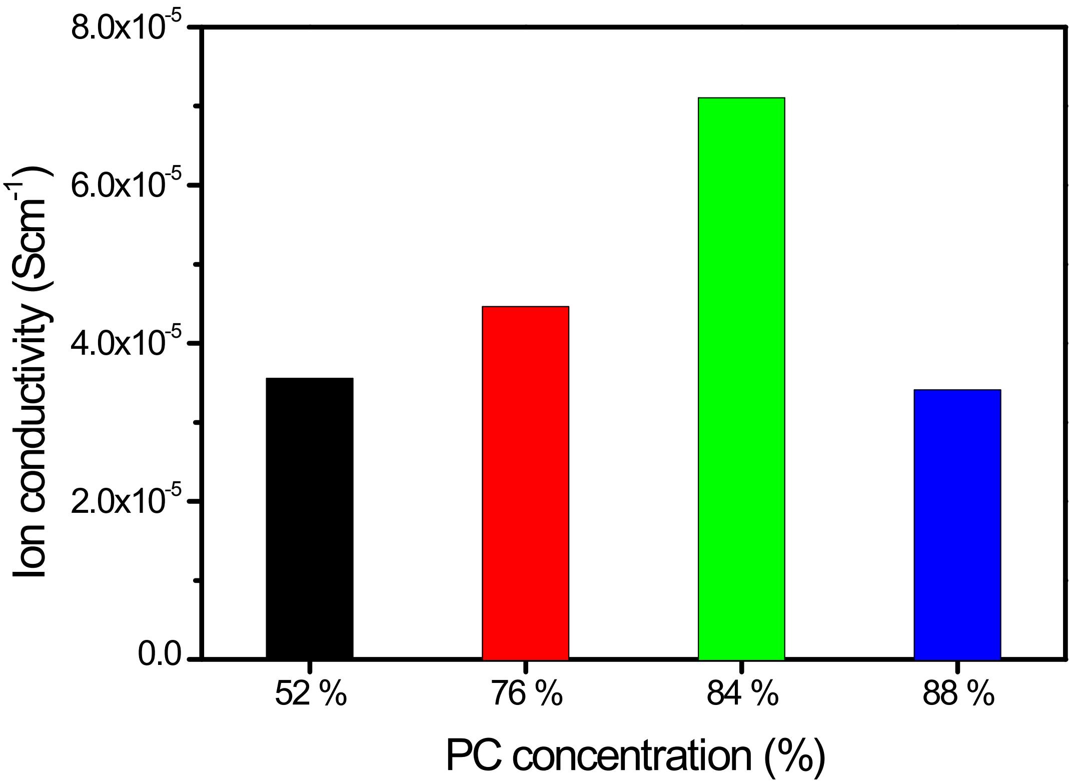

Figure S6. Ionic conductivity of SBS-g-POEM block-graft copolymer electrolyte with different LiTFSI concentrations at 25 °C. The PC concentration was fixed at 84%.

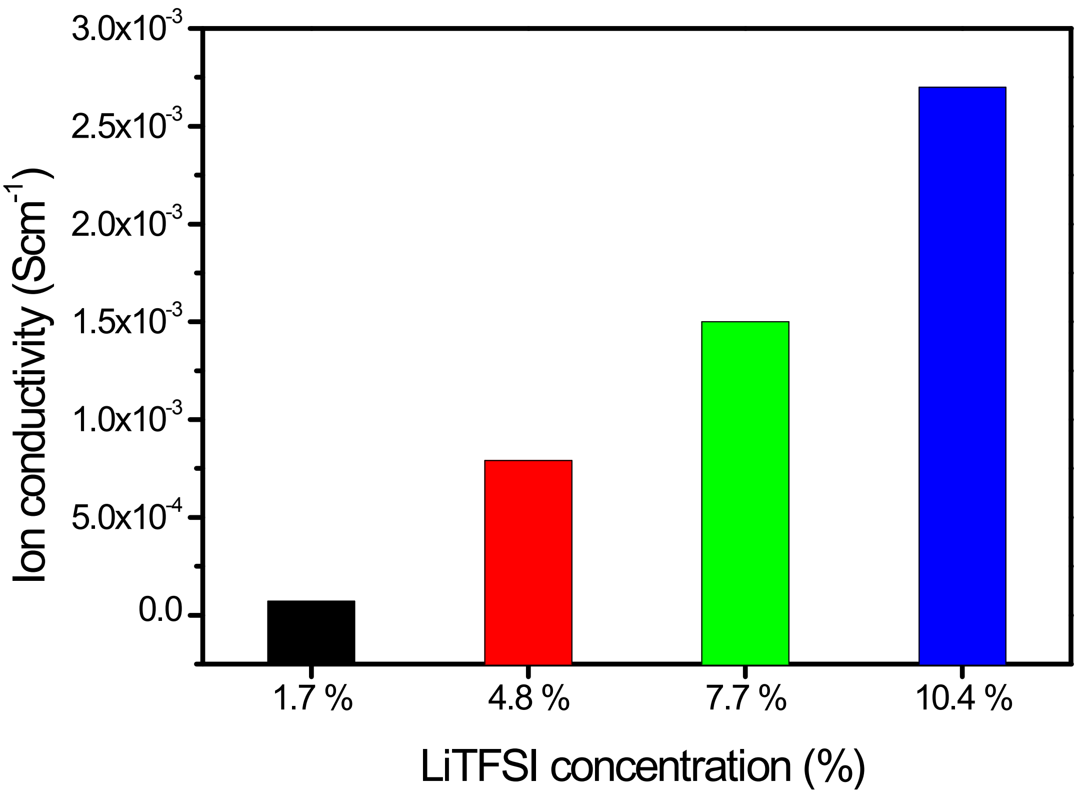

Figure S7. Ionic conductivity of neat SBS electrolyte and SBS-g-POEM block-graft copolymer electrolyte at 25 °C.

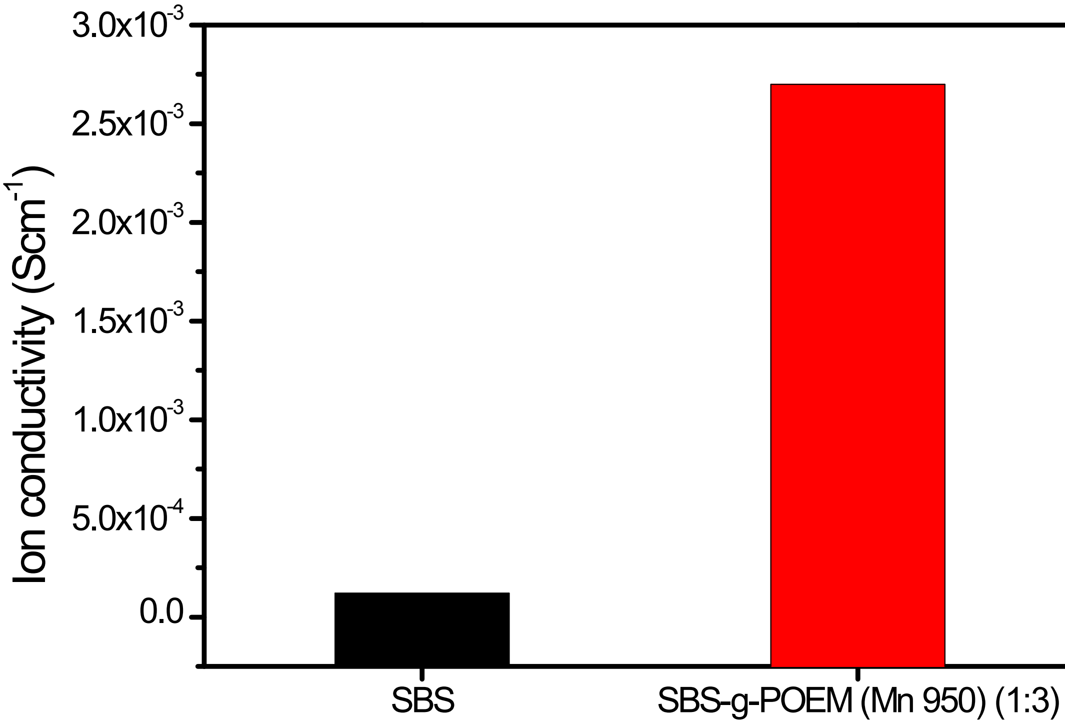

Figure S8. (a) Photos of electrolyte solutions of SBS (left) and SBS-g-POEM (right). (b) Photos of electrolyte films of SBS (left) and SBS-g-POEM (right) after evaporation of the solvent.

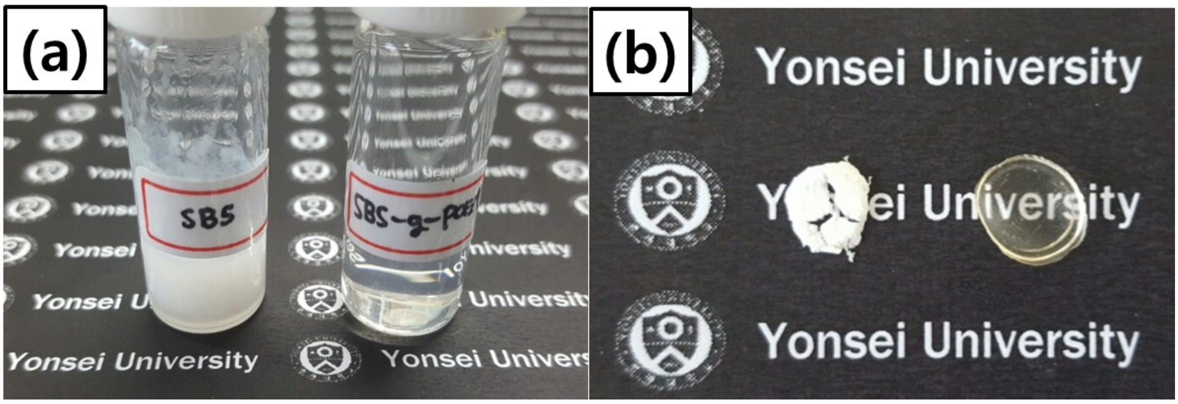

Figure S9. SEM images of activated carbon/carbon black/PVDF coated carbon paper substrates.

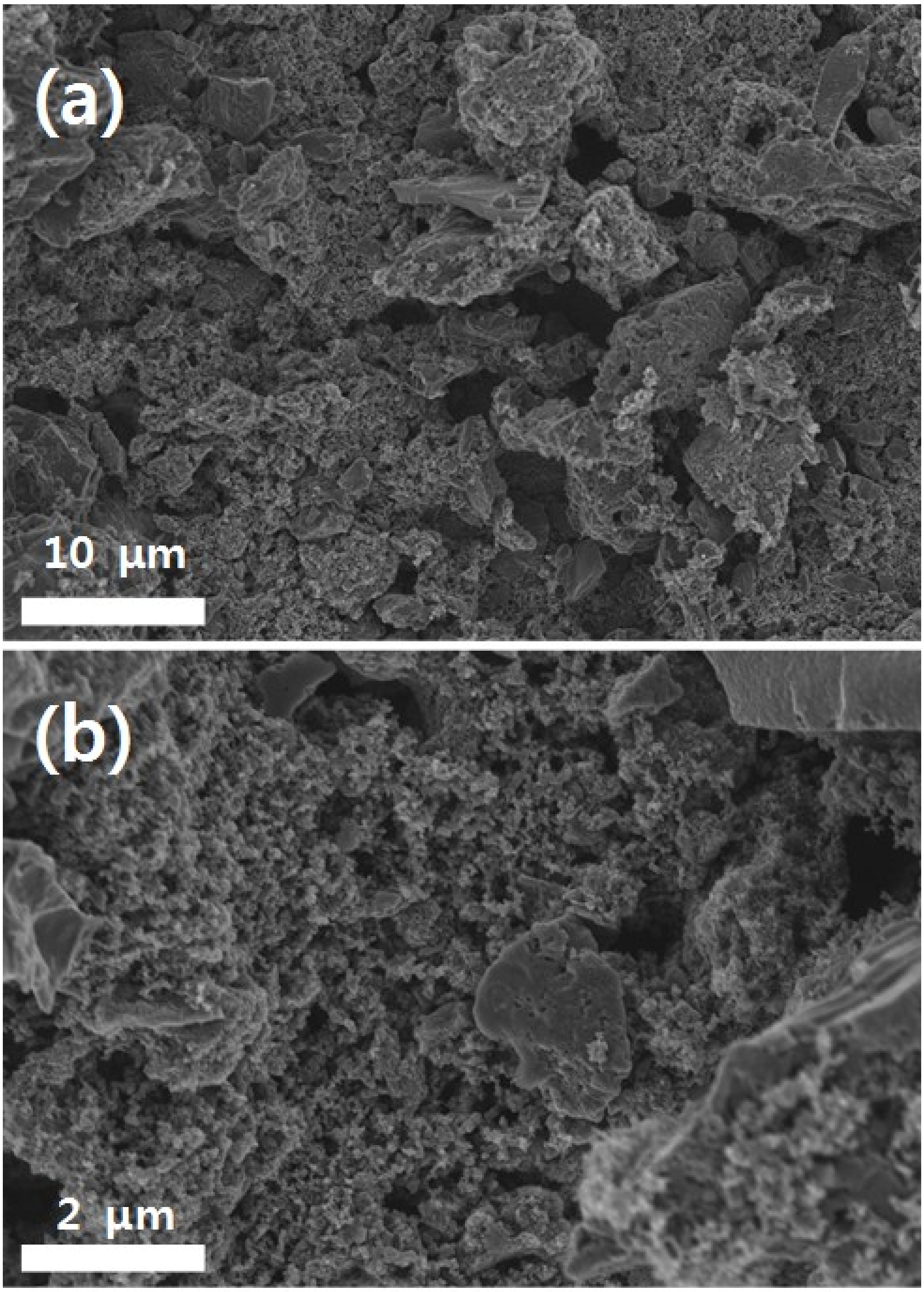

Figure S10. (a) CV curves of supercapacitor cell fabricated with SBS-g-POEM electrolyte at various bending angles. (b) photographs of SBS-g-POEM supercapacitor cell.

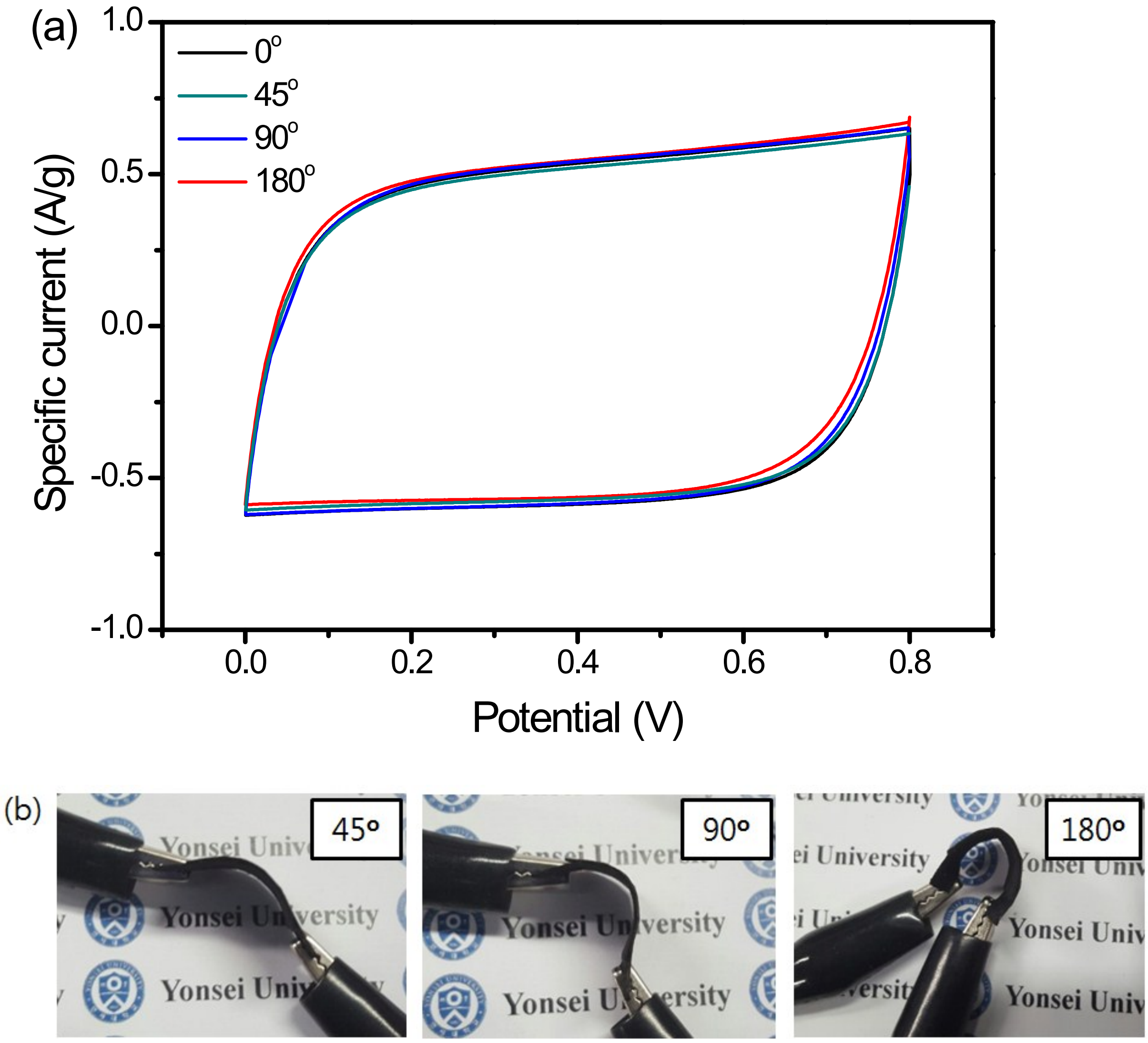

Figure S11. Galvanostatic charge-discharge curves of (a) supercapacitor cells at a constant current of 1 mA, (b) cell with PVA/H_3PO_4 and (c) cell with SBS-g-POEM electrolyte at different currents of 0.5 mA, 1 mA and 5 mA.

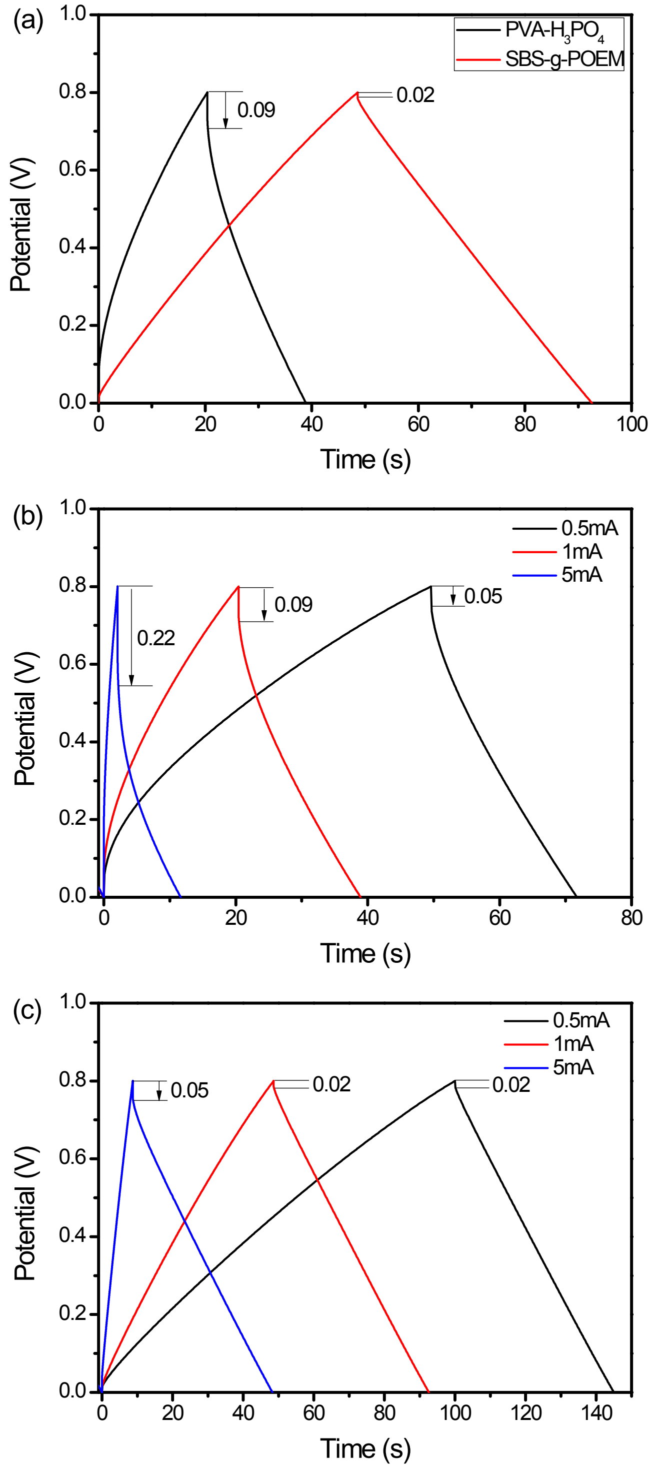

Figure S12. Nyquist plots for supercapacitors in the range of 100 kHz to 1 Hz.