

Supporting Information for

**Enhanced Supercapacitive Performances Functionalized Activated Carbon
in Novel Gel Polymer Electrolytes with Ionic Liquid redox-mediated
Poly(vinyl alcohol)/Phosphoric Acid**

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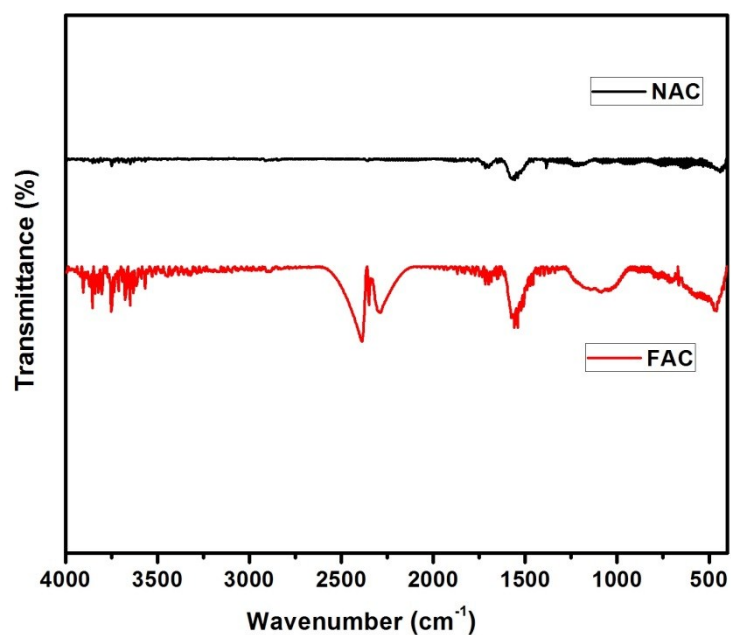


Fig. S1. FTIR spectrum of normal activated carbon (NAC) and nitric acid functionalized activated carbon (FAC); The functionalized activated carbon shows a small band at 1720 cm^{-1} attributable to ($\text{-C}=\text{O}$) stretching vibration and a broad band at 1550 cm^{-1} represents the (-COO^-) stretching vibrations associated with the presence of the carboxylic acid group. The broad band at 1250 cm^{-1} corresponds to the ($\text{-C}-\text{O}$) stretching vibrations [S1, S2]. These confirm the enhancement of carboxylic functional groups in FAC.

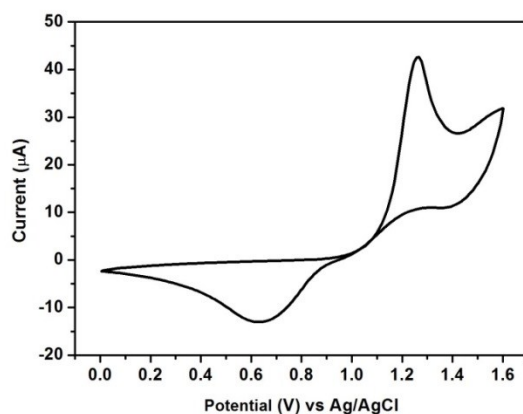


Fig. S2. CV curve of 0.1 M [EMIM]BF₄ in aqueous solution, measured using three electrode system (working electrode Pt disk, reference electrode Ag/AgCl; counter electrode Pt wire)

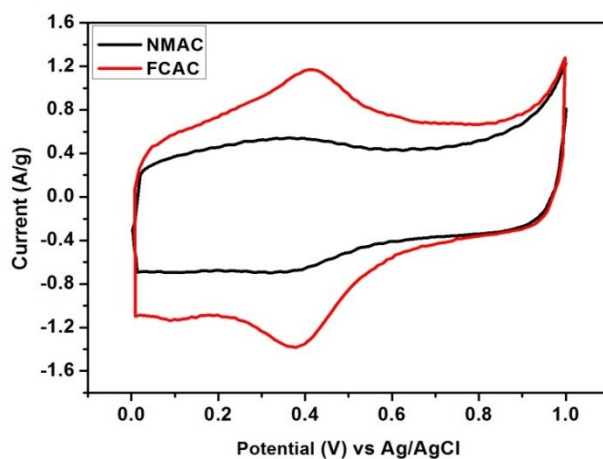


Fig. S3. CV curve of normal and functionalized activated carbon electrode in 1M H₂SO₄ electrolyte at 5 mVs⁻¹ scan rate, measured using three electrode system (reference electrode Ag/AgCl; counter electrode Pt plate)

Table S1. Specific capacitance value calculated from CV curves of normal and functionalized activated carbon

Activated Carbon	5 mV/s	10 mV/s	25 mV/s	50 mV/s	100 mV/s
NMAC	97	93	88	85	81
FCAC	155	147	140	135	126

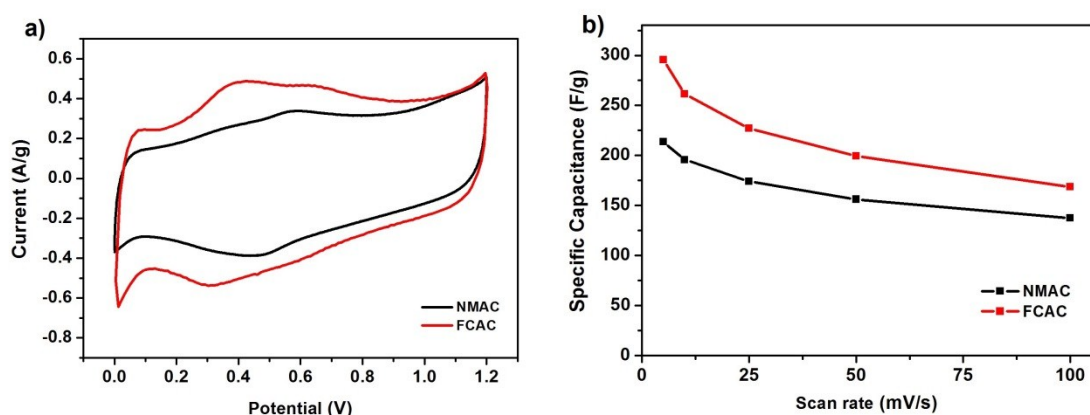


Fig. S4. a) CV curve of normal and functionalized activated carbon electrode based SCs in PVA/H₃PO₄/[EMIM]BF₄(50%) electrolytes at 5 mVs⁻¹ scan rate, measured using full cell configuration; b) variation of specific capacitance with respect to various scan rate for normal and functionalized activated carbon electrode based SCs.

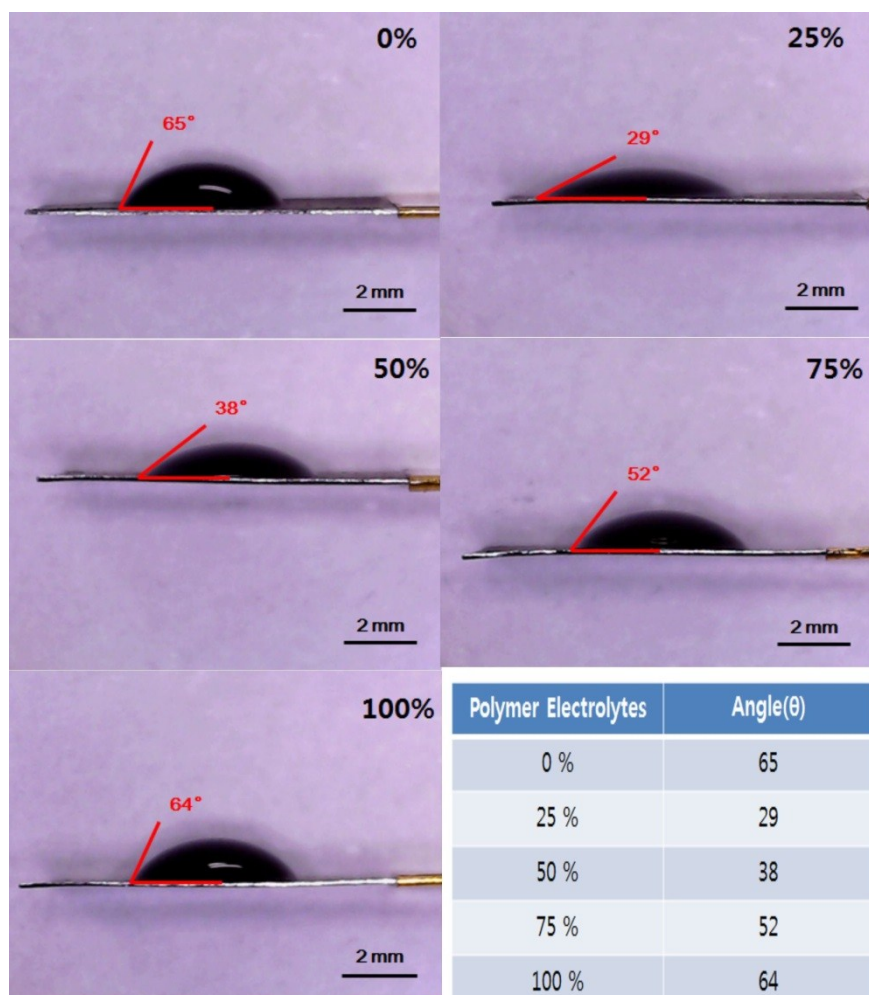


Fig. S5. Mesurment of various combination of polymer electrolytes contact angle of carbon electrode



Fig. S6. The photograph of 75% and 100% [EMIM]BF₄/ PVA/H₃PO₄ gel polymer electrolyte, highlighting the formation of curdy white precipitate. The dried composition of these electrolytes show completely opaque thin films.

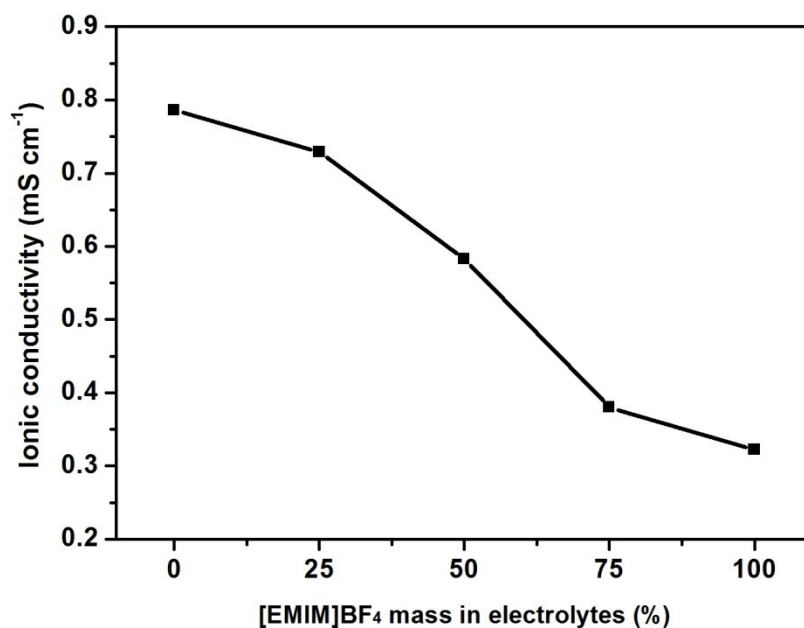


Fig. S7. Ionic conductivity of completely dried PVA/H₃PO₄/[EMIM]BF₄ (0, 25, 50, 75 and 100 wt. %) polymer electrolyte

References

- S1. U. Kirchner, V. Scheer and R. Vogt R, *J. Phys. Chem. A*, 2000, **104**, 8908-8915
- S2. P. Dubey, D. Muthukumar, S. Dash, R. Mukopadhyay and S. Sarkar, *Pramana J. Phys.* 2005, **65**(4), 681