

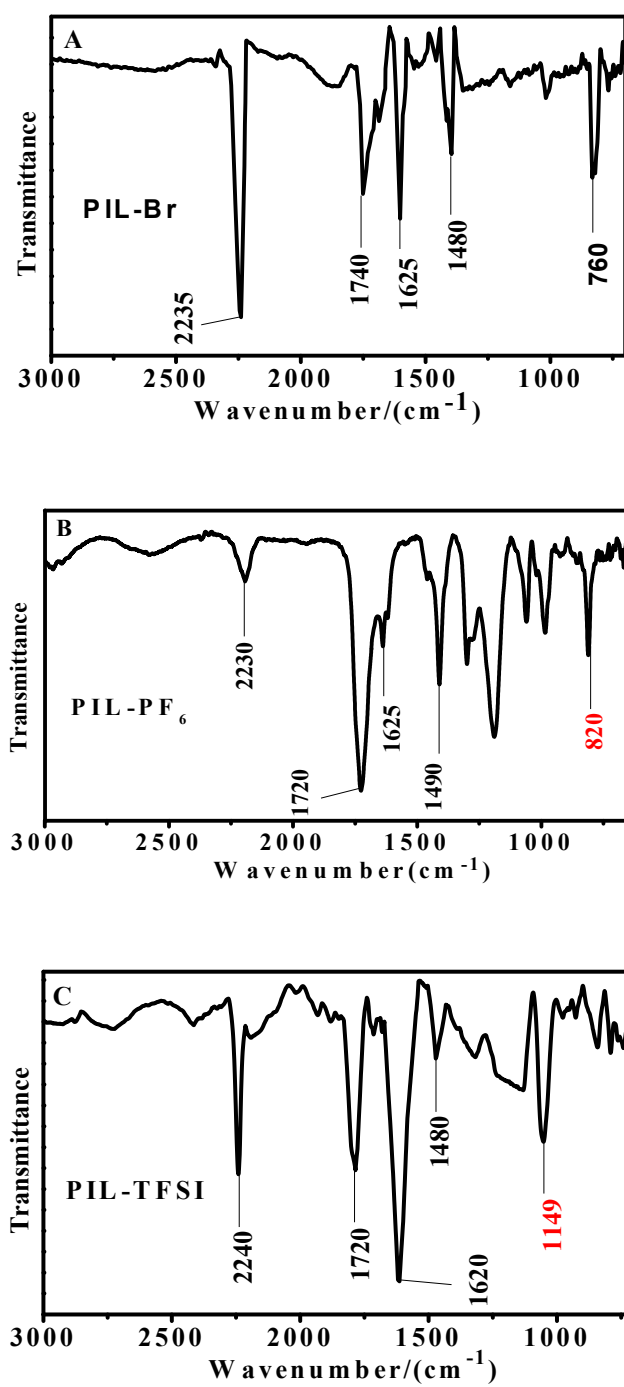
## **Electronic Supplementary Information**

### **Thermo- and pH-Responsive Poly(ionic liquid) Membranes**

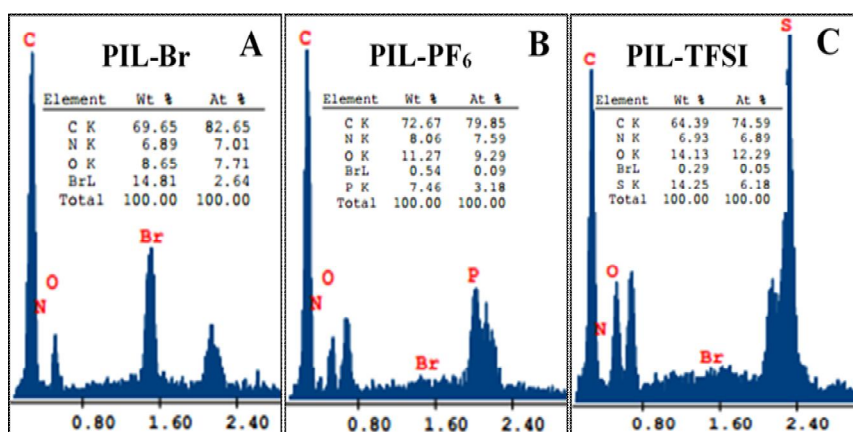
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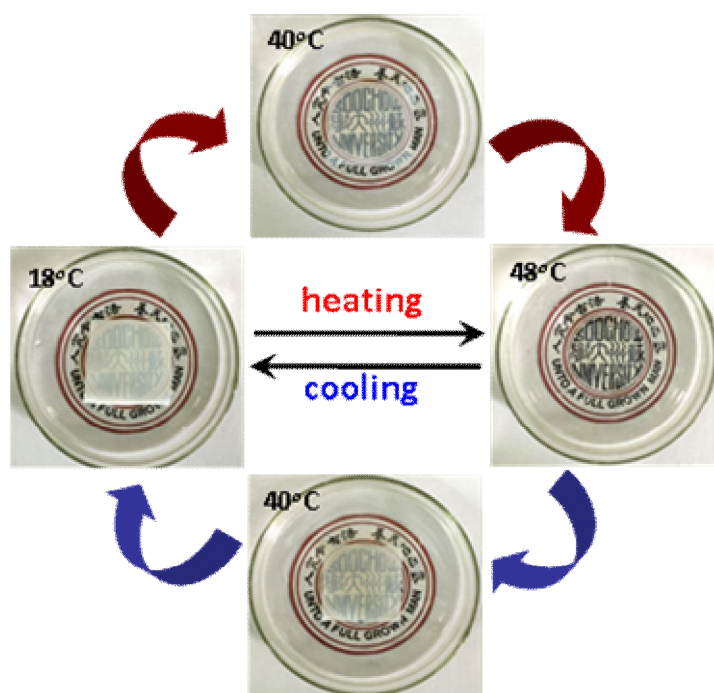
E-mail: [fyan@suda.edu.cn](mailto:fyan@suda.edu.cn)



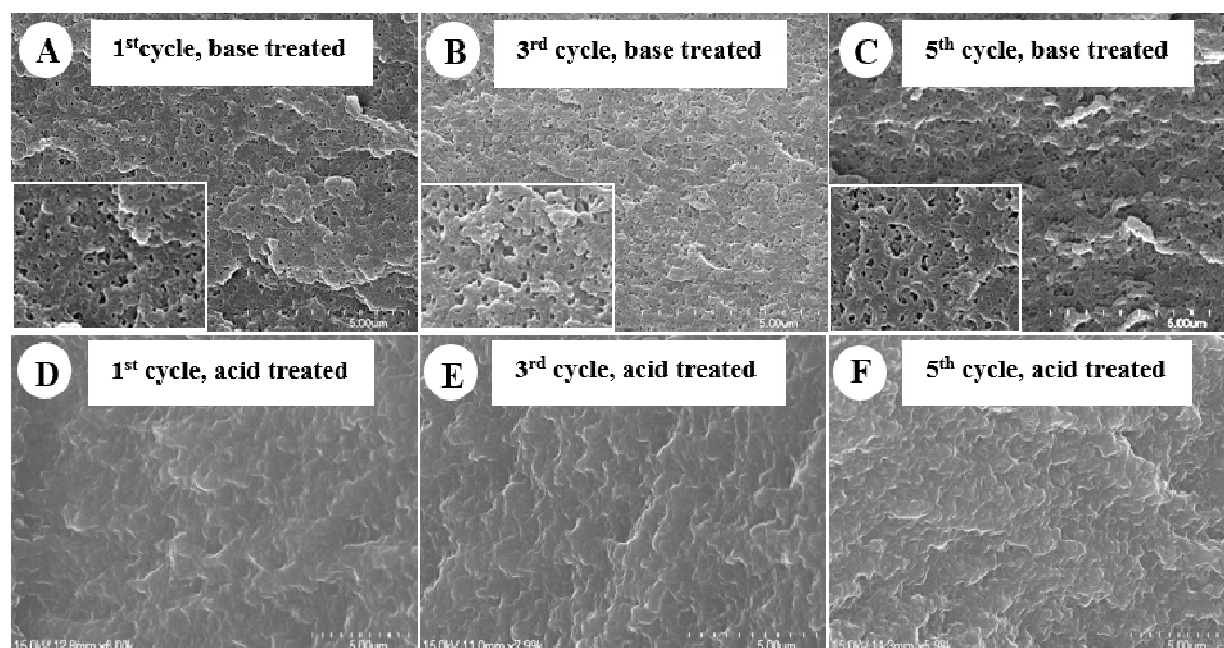
**Figure S1** FT-IR spectra of the A)  $\text{AA}_{0.3}\text{-NIPAM}_{0.3}\text{-PIL-Br}$ , B)  $\text{AA}_{0.3}\text{-NIPAM}_{0.3}\text{-PIL-PF}_6$ , C)  $\text{AA}_{0.3}\text{-NIPAM}_{0.3}\text{-PIL-TFSI}$  membranes.



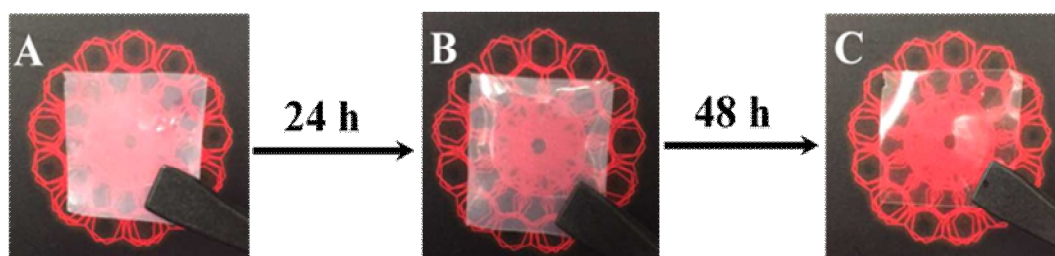
**Figure S2** Energy-dispersive X-ray (EDX) spectra of A) AA<sub>0.3</sub>-NIPAM<sub>0.3</sub>-PIL-Br, B) AA<sub>0.3</sub>-NIPAM<sub>0.3</sub>-PIL-PF<sub>6</sub> and C) AA<sub>0.3</sub>-NIPAM<sub>0.3</sub>-PIL-TFSI.



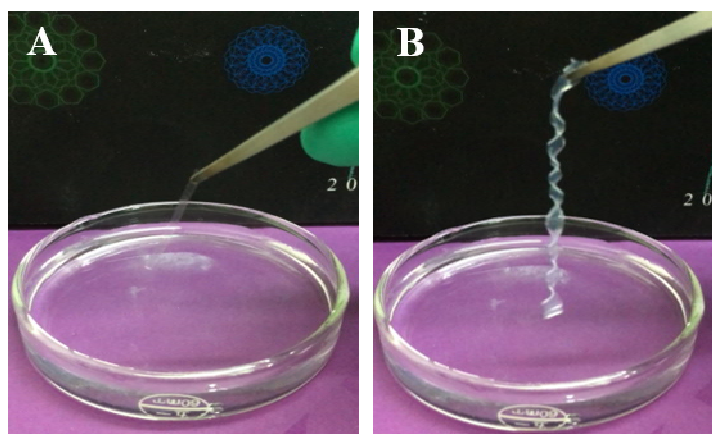
**Figure S3** The images of AA<sub>0.5</sub>-NIPAM<sub>0.1</sub>-PIL-TFSI membrane corresponding to the temperature dependence of the transmittance change from 18 to 50 °C, with the heating and cooling rate at 1 °C min<sup>-1</sup>.



**Figure S4** The SEM images of the fracture cross section of the AA<sub>0.5</sub>-NIPAM<sub>0.1</sub>-PIL-TFSI membrane: (A-C) The membranes after several alkaline solution (pH=11); and then after several acid solution (D-F).



**Figure S5** The photographs of A) AA<sub>0.5</sub>-NIPAM<sub>0.1</sub>-PIL-TFSI membrane; and be immersed in saturated  $\beta$ -CD aqueous solution for B) 24 h and C) 48 h.



**Figure S6.** The photographs of AA<sub>0.5</sub>-NIPAM<sub>0.1</sub>-PIL-TFSI/β-CD membrane A) initial state, and B) be immersed in the alkaline solution (pH=11) for 20 seconds.