Supporting Information

Advanced Charged Porous Membrane with Flexible Crosslinking Structure for Vanadium Flow Batteries

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Chloromethylation of polysulfone: Chloromethyl polysulfone (CMPSF) was prepared by the method reported in our previous paper[1]: A 10 g of polysulfone (Udel P3500, Solvay) was dissolved in a 400 mL of trichloromethane (Tian Jiang Kermel Chemical reagent Co., Ltd.), which was dehydrated with 4 Å molecular sieve for 24 h, in a three-necked round-bottomed flask at room temperature. Under nitrogen protection, A 800 μL of anhydrous $SnCl_4$ (sluopharm Chemical reagent Co., Ltd.) and a 17 mL of chloromethyl methyl ether (Nan Jing Hengchang Biomedical Co., Ltd.) were added slowly, respectively. The hybrid solution was stirred at 55°C for 24 h. The mixture was precipitated in excess and rigorously stirred methanol and maintained stirring for 24 h, then filtrated, washed by methanol and dried in vacuum at 50°C for 24 h. The chloromethlated degree (CD) of synthesized CMPSF was measured by ^{1}H NMR (nuclear magnetic resonance) (Figure S2).

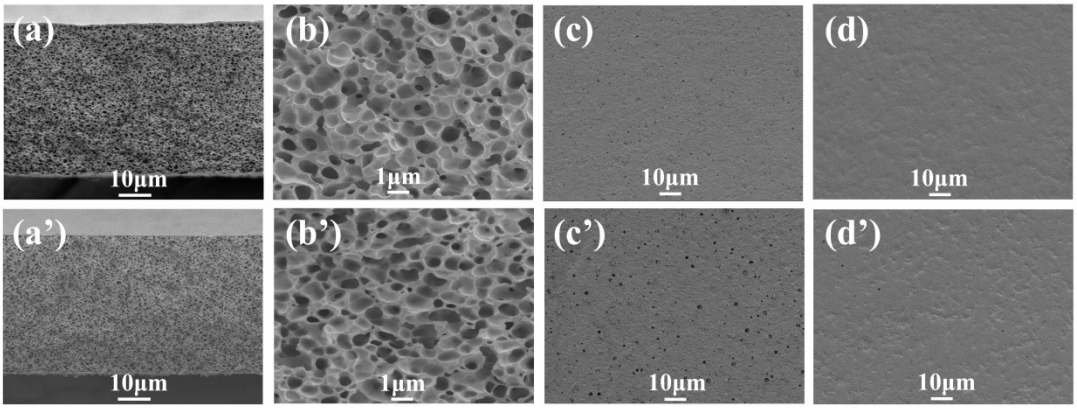

Figure S1. The SEM images of cross-section and surface of CMPSF-butane before (a-d) and after cycling (a'-d'): (a, b and a', b') cross-section and magnified cross-section of CMPSF-butane; (c, d and c', d') the surface morphology upon vapor side and glass side of CMPSF-butane

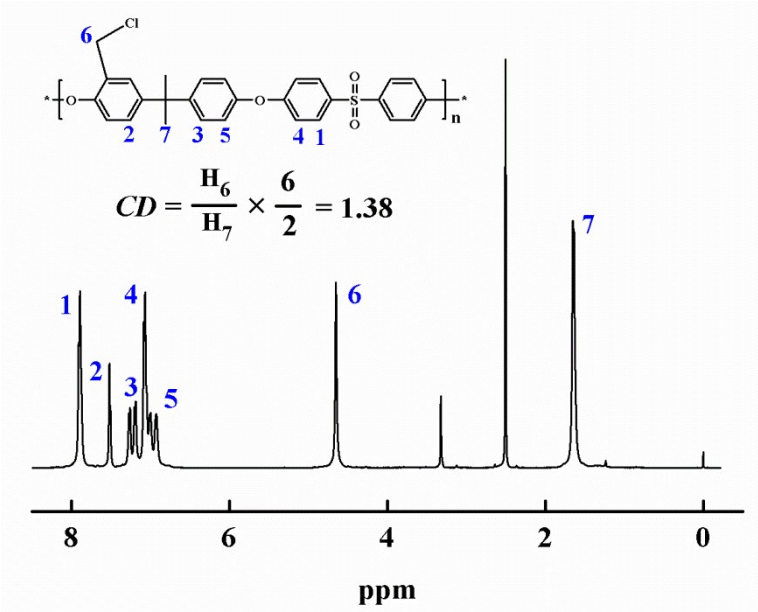

Figure S2. The ^{1}H NMR of synthesized CMPSF

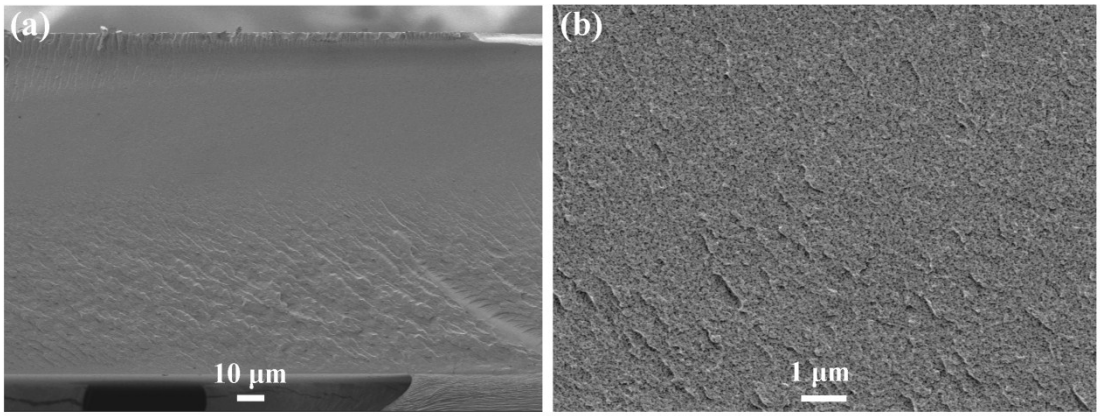

Figure S3. (a) and (b) the SEM images of cross-section and magnified cross-section of Nafion 115 membrane, respectively.

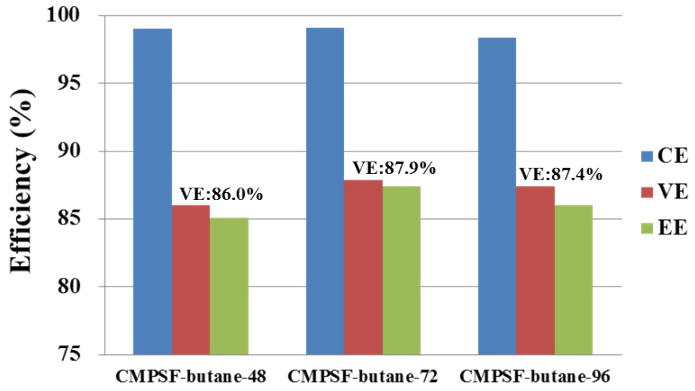

Figure S4. The VFB performance of the membranes with different crosslinking time.

Table S1. The changes of the mass, thickness and porosity before and after immersing VO_2^+ solution.

	Dried mass (g)		Wet thickness (μm)		Porosity (%)	
	before	after	before	after	before	after
Nafion 115	0.4942	0.4832	141±1	141±1	—	—
CMPSF-butane	0.0628	0.0600	45±1	45±1	72.47±1.50	72.21±1.50

1. F. Zhang, H. Zhang and C. Qu, *ChemSusChem*, 2013, **6**, 2290-2298.