

## Electronic Supplementary Information

### ROMP-type epoxy-functionalized norbornene copolymer and its hybrid alkaline anion exchange membranes preparation and application

Xiaohui He,<sup>\*a</sup> Zhilong Han,<sup>a</sup> Yingping Yang,<sup>a</sup> Suli Wang,<sup>a</sup> Guangshui Tu,<sup>a</sup>  
Shengmei Huang,<sup>a,c</sup> Feng Zhang,<sup>a</sup> and Defu Chen<sup>b</sup>

<sup>a</sup>School of Materials Science and Engineering, Nanchang University, 999 Xuefu Avenue, Nanchang 330031, China

<sup>b</sup>School of Civil Engineering and Architecture, Nanchang University, 999 Xuefu Avenue, Nanchang 330031, China

<sup>c</sup>School of Materials Science and Engineering, Nanchang Hangkong University, Nanchang 330063, China

Correspondence to: X. He (E-mail: hexiaohui@ncu.edu.cn)

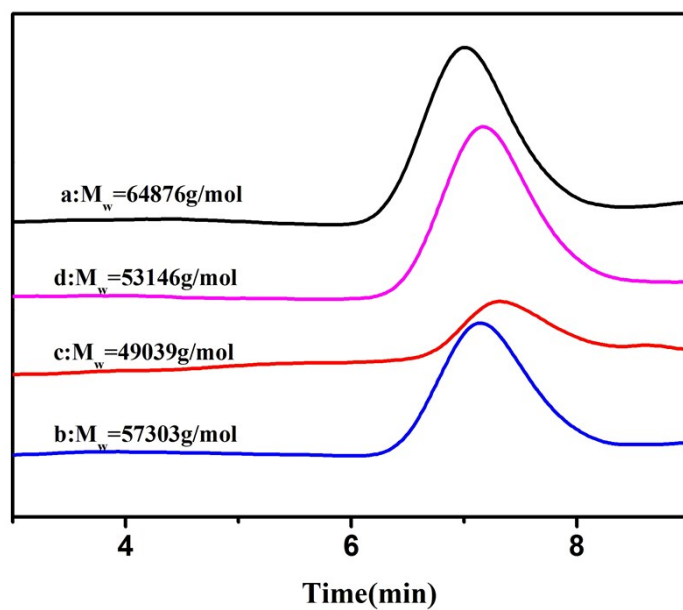
#### Materials

N-Trimethoxysilylpropyl-N,N,N-Trimethylammonium chloride (TSPCA), glutaraldehyde (GA), 5-Norbornene-2-methanol, Sodium hydroxide (NaH), Grubbs's 1st catalyst [ $\text{Cl}_2(\text{PCy}_3)_2\text{Ru}=\text{CH-Ph}$ ] were used from Energy Chemical Co. Ltd. Epoxy chloropropane, 2-Bromobutane, Hydrochloric acid were provided by Tianjin Damao Chemical Co. Ltd. Tetrahydrofuran, Toluene, Hexane and Dichloromethane were distilled from sodium and benzophenone under nitrogen.

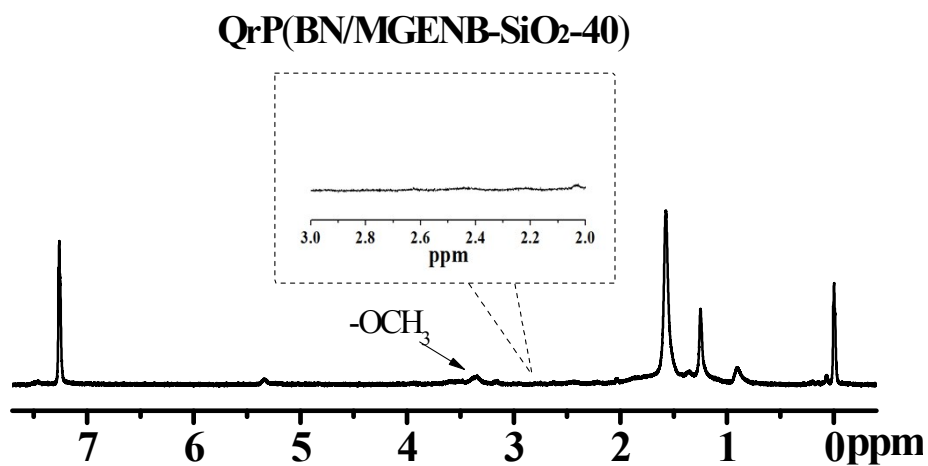
#### Characterization

<sup>1</sup>H-NMR and <sup>13</sup>C-NMR spectra were measured on a ARX600 Nuclear Resonance Spectrograph by Bruker. Chloroform-d was used as solvent. The BN and MGENB monomer, copolymer and hybrid membrane were determined from the respective NMR spectra. TGA-7 Perkin Elmer thermal analyzer was used to check the identification of the thermal stability with a heating rate of 10 °C/min. MTS CMT8502 was used to describe the mechanical properties of the hybrid membranes.

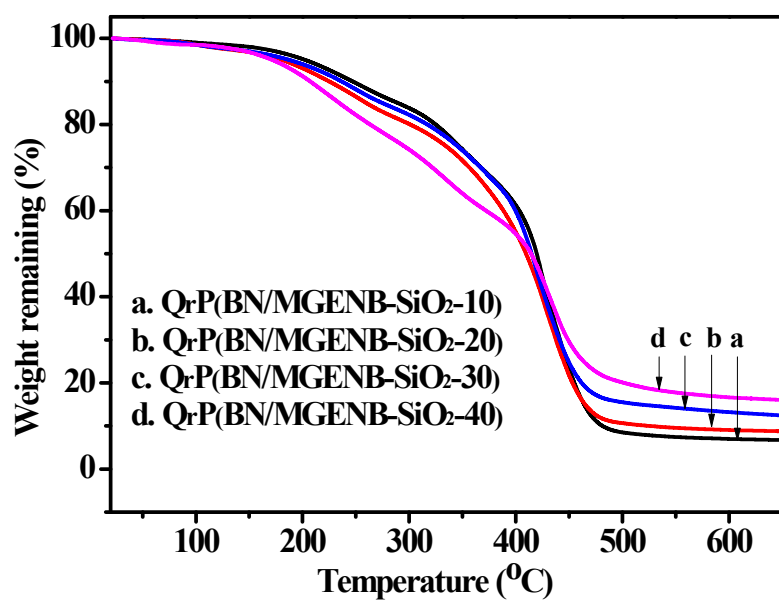
The gel permeation chromatography (GPC) was conducted with a Breeze Waters system equipped with a Rheodyne injector, a 1515 Isocratic pump, and a Waters 2414 differential refractometer by using polystyrenes as the standard and tetrahydrofuran (THF) as a solvent.



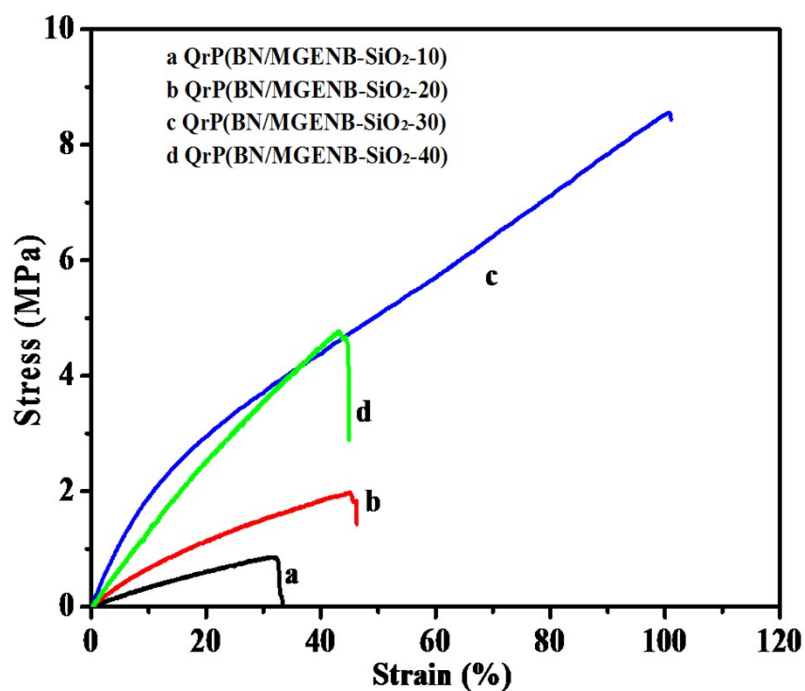
**Fig. S1** GPC curves of ROMP-type epoxy-functionalized norbornene copolymers: (a) rP(BN/MGENB)-49.2, (b) rP(BN/MGENB)-37.3, (c) rP(BN/MGENB)-28.5, (d) rP(BN/MGENB)-21.3



**Fig. S2** <sup>1</sup>H NMR spectrum of copolymer/silica hybrid membrane QrP(BN/MGENB-SiO<sub>2</sub>-40)



**Fig. S3** TGA curves of copolymer/silica hybrid membranes: (a) QrP(BN/MGENB-SiO<sub>2</sub>-10), (b) QrP(BN/MGENB-SiO<sub>2</sub>-20), (c) QrP(BN/MGENB-SiO<sub>2</sub>-30), (d) QrP(BN/MGENB-SiO<sub>2</sub>-40)



**Fig. S4** Tensile curves of copolymer/silica hybrid membranes: (a) QrP(BN/MGENB-SiO<sub>2</sub>-10), (b) QrP(BN/MGENB-SiO<sub>2</sub>-20), (c) QrP(BN/MGENB-SiO<sub>2</sub>-30), (d) QrP(BN/MGENB-SiO<sub>2</sub>-40)

**Table S1** The molecular weight and molecular distribution of ROMP-type epoxy-functionalized norbornene copolymer

| Sample            | $M_w$ (g/mol) | PDI  |
|-------------------|---------------|------|
| rP(BN/MGENB)-21.3 | 53146         | 1.69 |
| rP(BN/MGENB)-28.5 | 49039         | 1.67 |
| rP(BN/MGENB)-37.3 | 57303         | 1.66 |
| rP(BN/MGENB)-49.2 | 64876         | 1.62 |

Mol% MGENB calculated by <sup>1</sup>H NMR.

**Table S2** The solubility of the copolymer

| <b>Sample</b>     | <b>THF</b> | <b>CHCl<sub>3</sub></b> | <b>Toluene</b> |
|-------------------|------------|-------------------------|----------------|
| rP(BN/MGENB)-21.3 | +          | +                       | +              |
| rP(BN/MGENB)-28.5 | +          | +                       | +              |
| rP(BN/MGENB)-37.3 | +          | +                       | +              |
| rP(BN/MGENB)-49.2 | +          | +                       | +              |

+: soluble at room temperature    ±: partially soluble at room temperature

–: insoluble at room temperature