Supporting information

Highly Stable Anion Exchange Membranes Based on Quaternized Polypropylene

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1. GPC measurement

The polymer molecular weights were also analyzed on a PL-220 series high temperature gel permeation chromatography (GPC) unit equipped with four PLgel Mixed-A (20μm) columns (Polymer Laboratory Inc.). The oven temperature was at 150 °C and the temperatures of autosampler's hot and the warm zones were at 135 °C and 130 °C respectively. The solvent 1, 2, 4-trichlorobenzene (TCB) containing ~200 ppm tris(2,4-di-tert-butylphenyl) phosphite (Irgafos 168) was nitrogen purged. The flow rate was 1.0 mL/min and the injection volume was 200 μl. A 2 mg/mL sample concentration was prepared by dissolving the sample in N_2 purged and preheated TCB (containing 200 ppm Irgafos 168) for 2.5 h at 160 °C with gentle agitation.

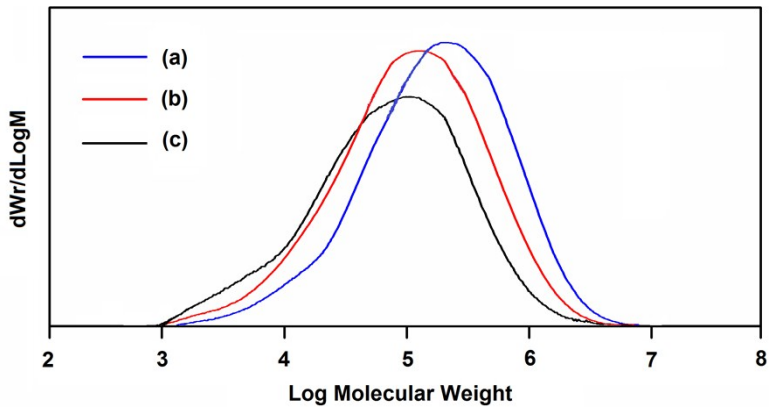

Fig. S1. GPC molecular weight distribution overlay of three PP based *co*- and terpolymer with incorporation of (a) 7.4%, (b) 20.8% and (c) 20.1%.

2. FT-IR measurement

Fourier transform infrared spectroscopy (FTIR) was recorded on a PE-1710 spectrometer from 4000 to 400 cm^{-1} with a 4 cm^{-1} resolution in 64 scans using polymer thin films (about 10 to 20 μm), which was prepared by compression-molding polymer powders between PTFE coated aluminum sheets at 190 °C and 25000 psi.

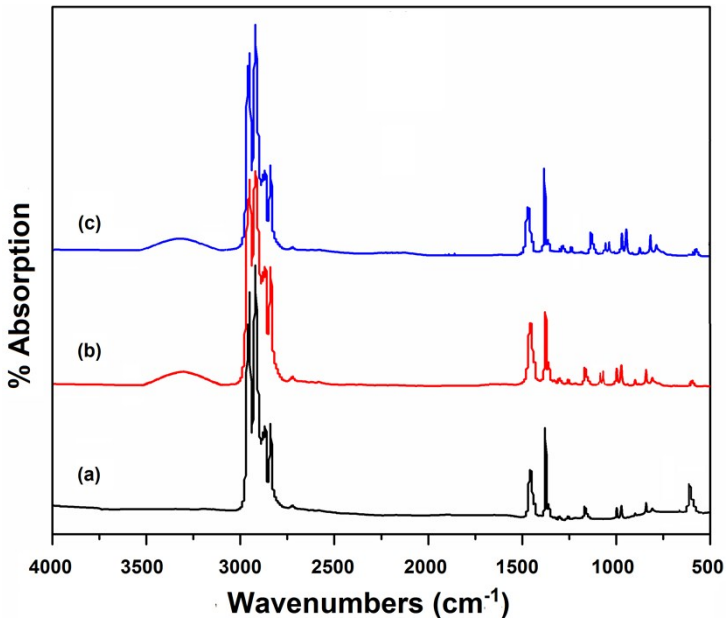

Fig. S2. FT-IR spectra of (a) PP-Br-20, (b) PP-TMA-20 and (c) PP-DMHDA-20 membranes in the hydroxide form.

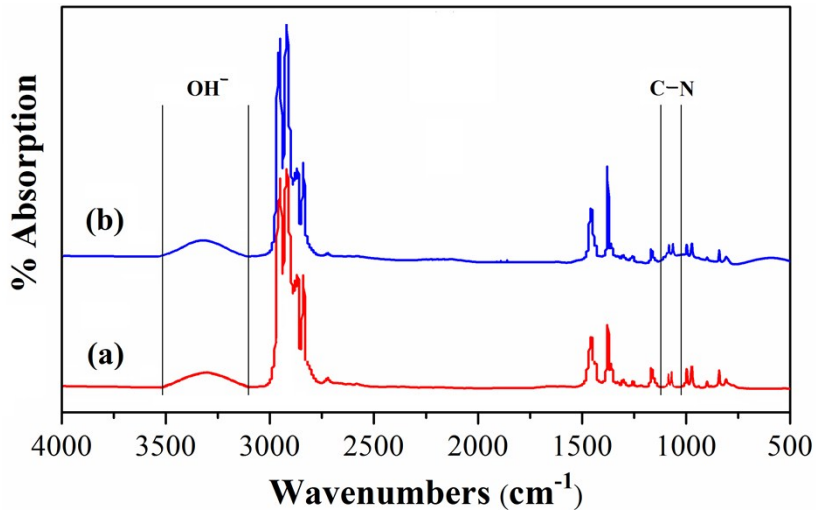

Fig. S3. The FT-IR spectra of changing trend for x-PP-DMHDA-20 AEM membranes after immersion in 10 M NaOH at 80 °C for: (a) 0 h and (b) 700 h.

3. NMR measurement

The polymer molecular weights were also analyzed on a PL-220 series high temperature gel permeation chromatography (GPC) unit equipped with four PLgel Mixed-A (20μm) columns (Polymer Laboratory Inc.). The oven temperature was at 150 °C and the temperatures of autosampler's hot and the warm zones were at 135 °C and 130 °C respectively. The solvent 1, 2, 4-trichlorobenzene (TCB) containing ~200 ppm tris(2,4-di-tert-butylphenyl) phosphite (Irgafos 168) was nitrogen purged. The flow rate was 1.0 mL/min and the injection volume was 200 μl. A 2 mg/mL sample concentration was prepared by dissolving the sample in N_2 purged and preheated TCB (containing 200 ppm Irgafos 168) for 2.5 h at 160 °C with gentle agitation.

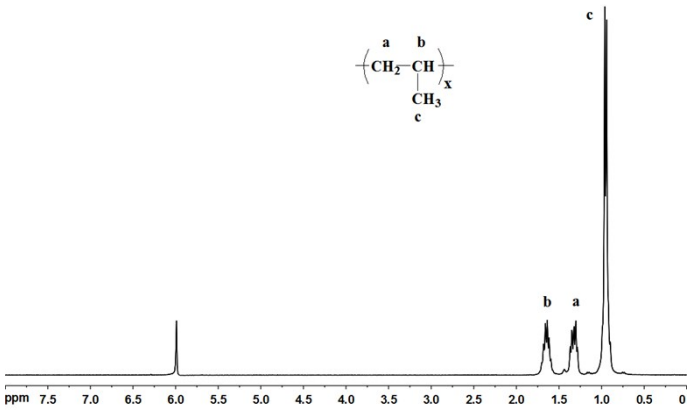

Fig. S4. ^{1}H NMR spectra of PP in 1,1,2,2-tetrachloroethane-d_2.

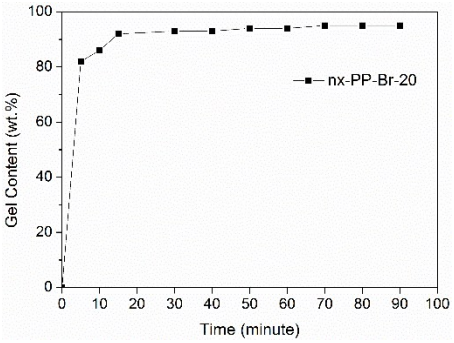

Fig. S5. Gel content of nx-PP-Br-20 (0.7 mol% of styrene group) versus different heating times on identical temperature of 220 ^{o}C.

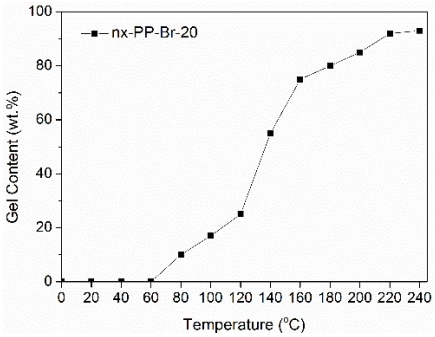

Fig. S6. Gel content of nx-PP-Br-20 (0.7 mol% of styrene group) versus different reaction temperatures on identical intervals of 15 minutes.

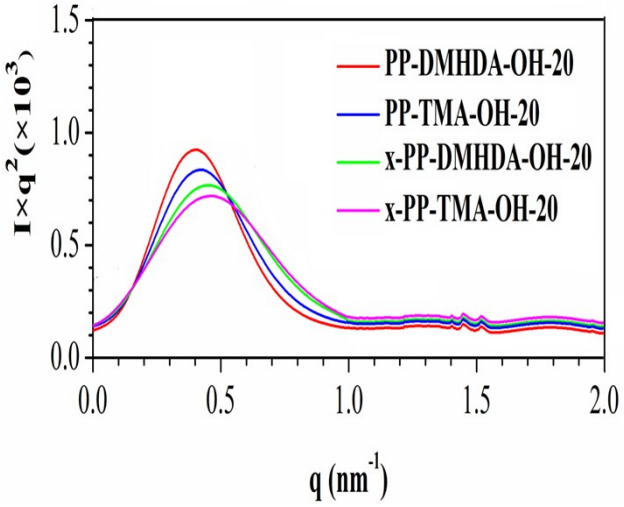

Fig. S7. SAXS profiles of dry polymer membranes.