Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Supporting Information

Engineering Block Co-polymer Anion Exchange Membrane Domains for Highly Efficient Electrode-Decoupled Redox Flow batteries

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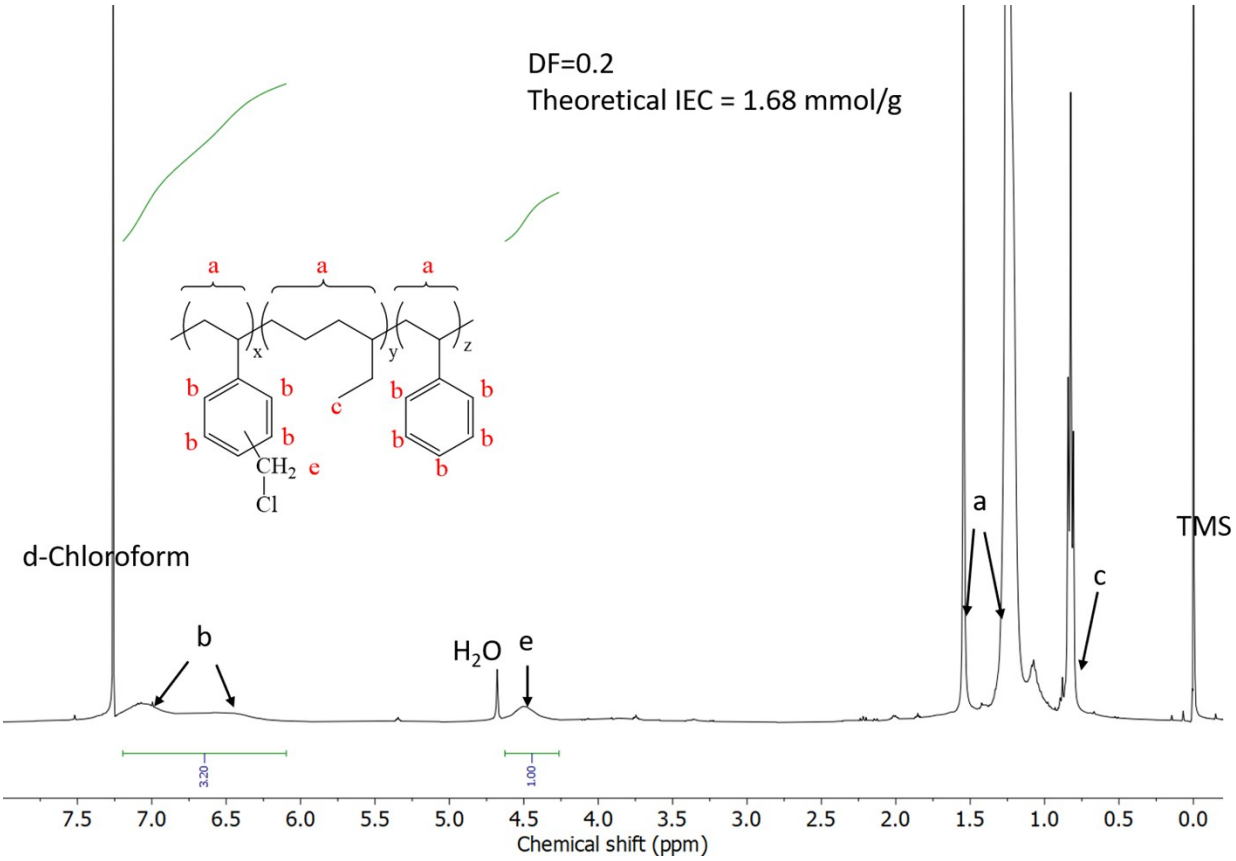

Figure S1. ^{1}H NMR spectrum of CMSEBS30. Peaks a and c correspond to the protons on aliphatic backbone. Peaks b correspond to the protons the aromatic ring. The new peak e demonstrated that the chloromethylation reaction occurred in the SEBS. The DF value for CMSEBS30 was calculated by using the following equation:

$$\frac{\frac{Area(e)}{2}}{\frac{Area(b) + \frac{Area(e)}{2}}{5}} \times 0.3$$

The ^{1}H NMR experiment was performed in chloroform-d with TMS, which was used as an internal standard for calibrating the chemical shift of ^{1}H.

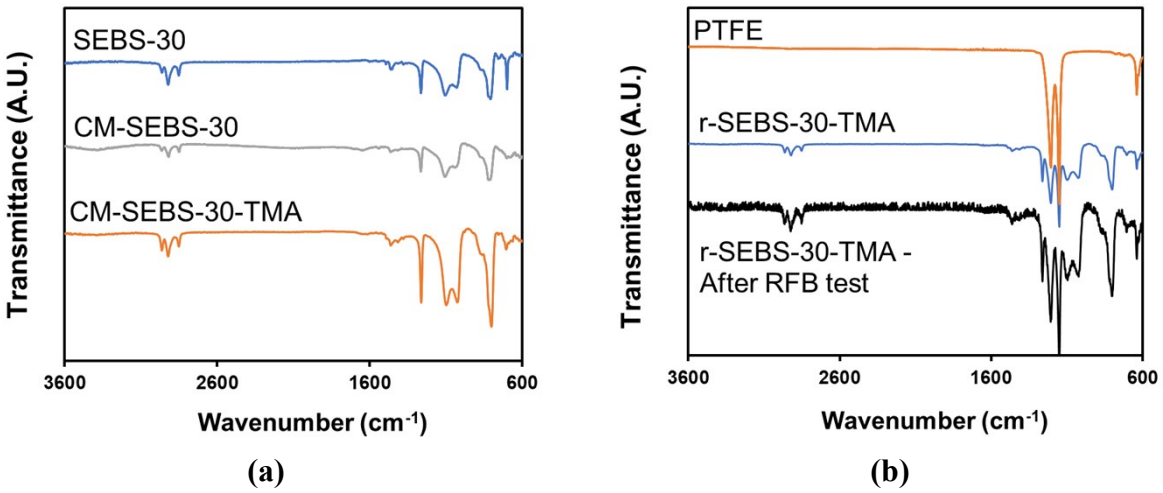

Figure S2. FTIR spectra of **(a)** SEBS polymer backbone, SEBS following chloromethylation reactions, CM-SEBS-TMA ionomer; **(b)** PTFE reinforcement, r-SEBS-TMA and the same ionomeric membrane separator after the RFB test.

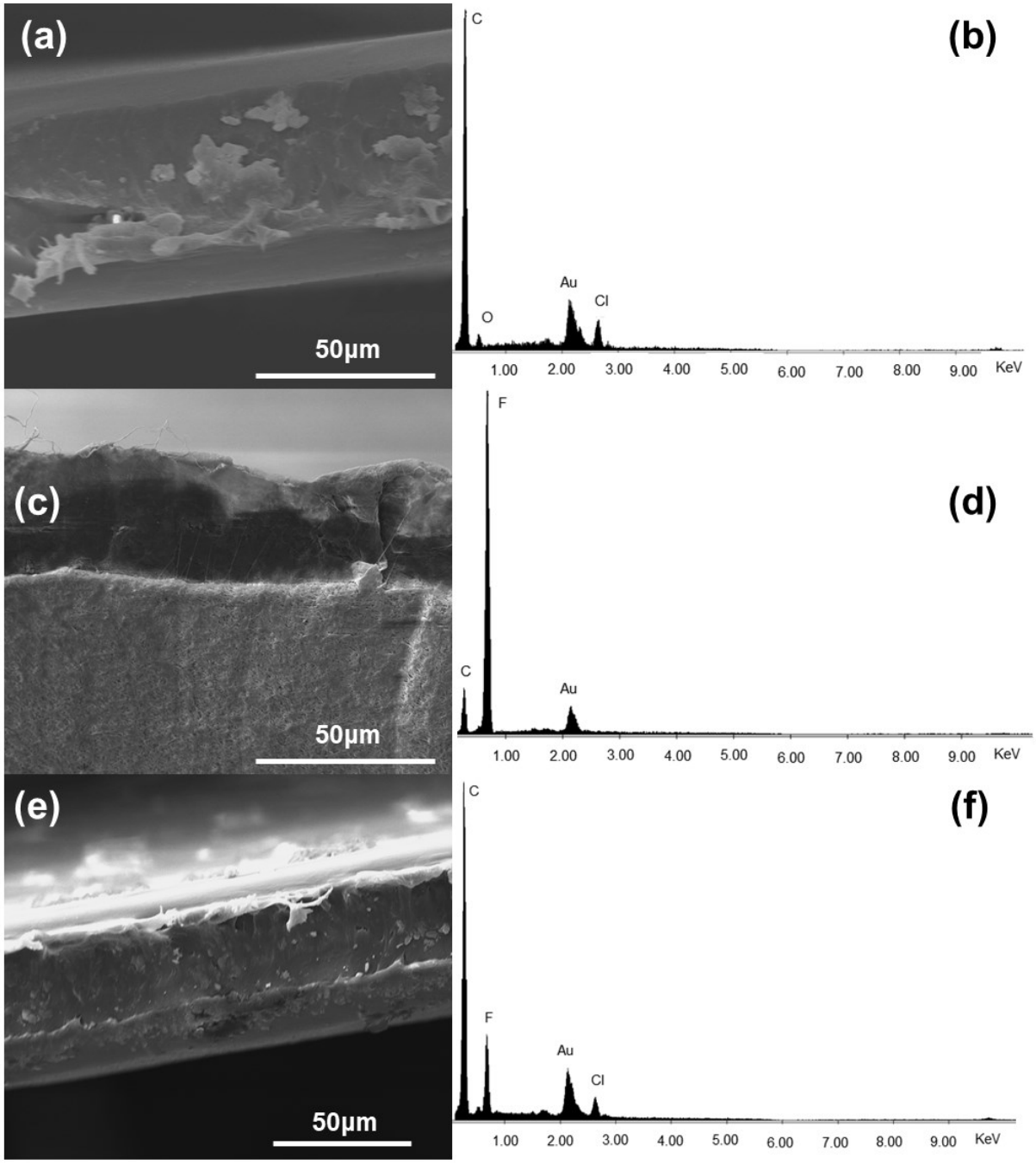

Figure S3. (a) cross-sectional SEM image of SEBS-TMA AEM, **(b)** spot EDAX spectra of SEBS-TMA AEM, **(c)** cross-sectional SEM image of ePTFE reinforcement, **(d)** spot EDAX spectra of ePTFE reinforcement, **(e)** cross-sectional SEM image of r-SEBS-TMA AEM, **(f)** spot EDAX spectra of r-SEBS-TMA AEM.

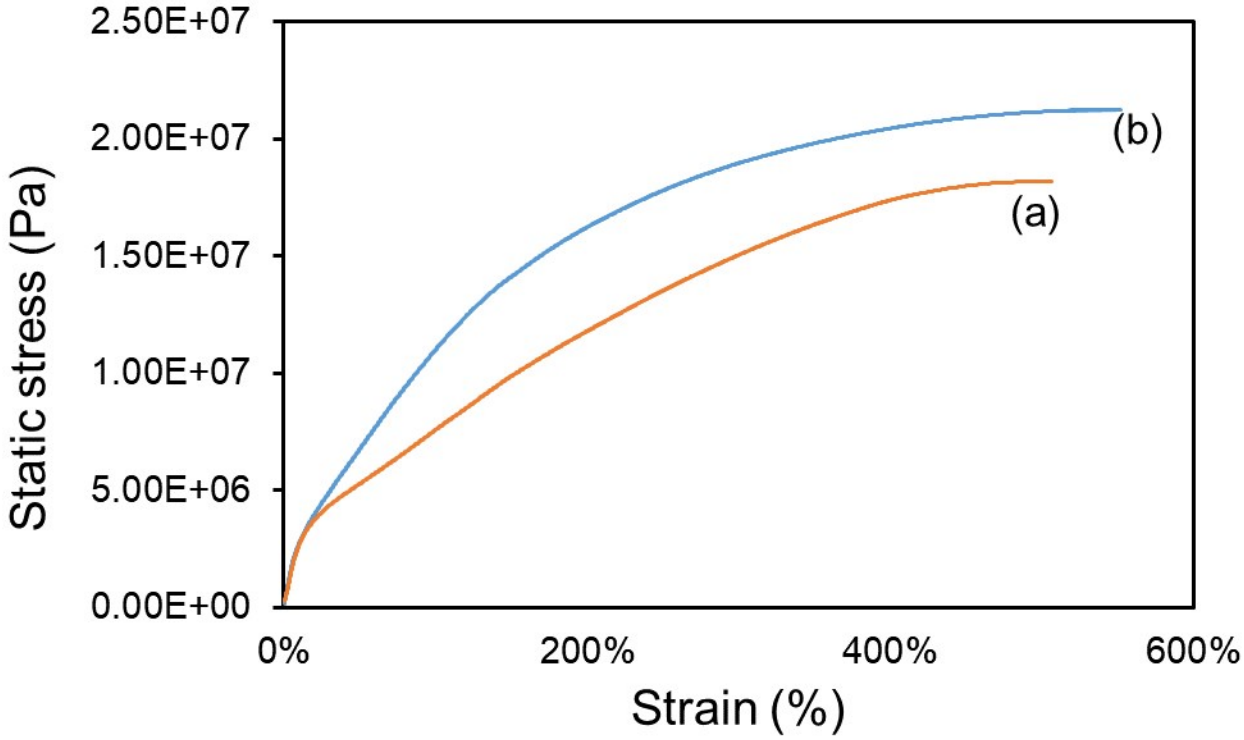

Figure S4. Stress-strain curve of (a) r-SEBS-TMA and (b) r-SEBS (before TMA functionalization).

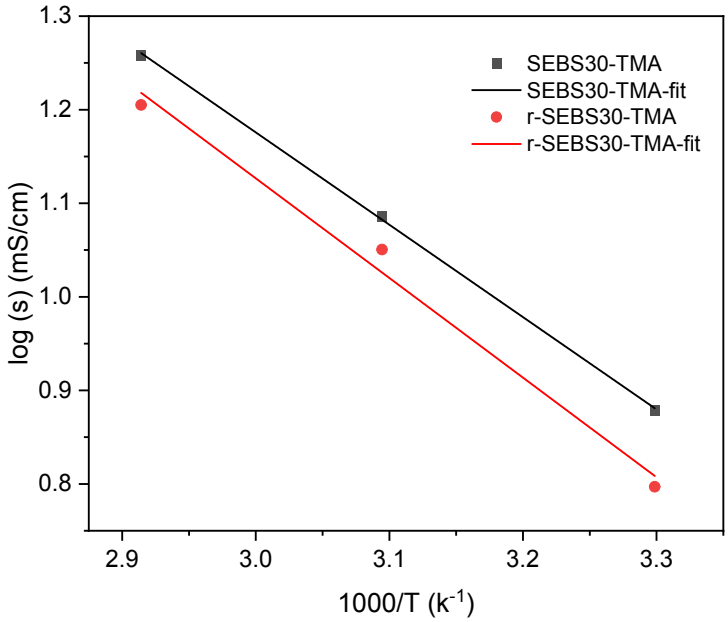

Figure S5. Arrhenius plot of ln σ vs. inverse temperature for SEBS-based AEMs.

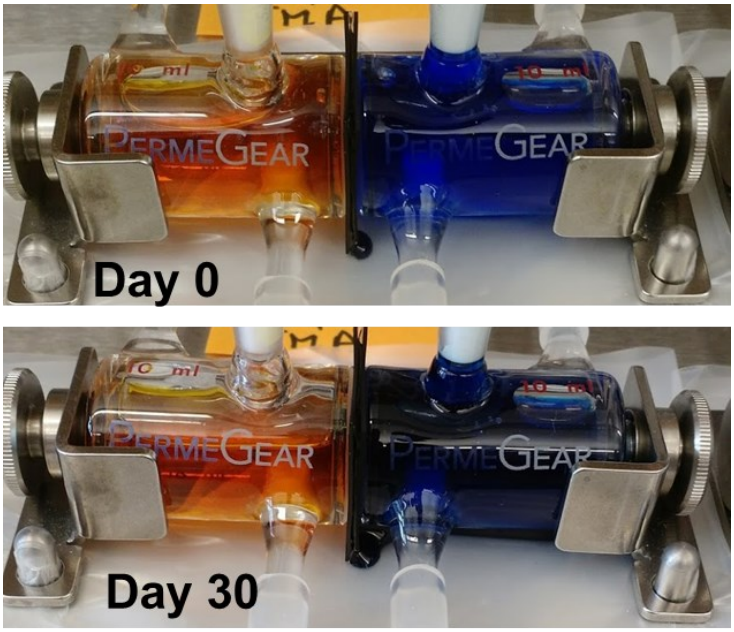

Figure S6. *Ex-situ*, temperature-controlled membrane cross-over experiments. The cerium electrolyte is on the left-hand chamber and vanadium electrolyte is on the right.

Table S1. Physical properties of ePTFE reinforcement

Property	
Thickness (μm)	25.4 ± 3
Gurley air flow (1inch^2 at 4.88inch water) (s)	25 ± 2
IPA bubble point (47mm ϕ sample) (KPa)	345 ± 28
Ultimate tensile stress (MPa)	17 ± 3
Elongation at break (%)	339 ± 42
Modulus (MPa)	14 ± 1.4
Ultimate tensile stress (after acid soak) (MPa)	15 ± 3
Elongation at break (after acid soak) (%)	260 ± 50
Modulus (after acid soak) (MPa)	13.6 ± 4
Thermal degradation onset (°C)	500 ± 10
Swelling ratio (%)	No appreciable swelling
Water uptake (%)	No appreciable water uptake after blotting out the film adsorption