

Supporting information for

**Di-piperidinium-crosslinked poly(fluorenyl-co-terphenyl
piperidinium)s toward high-performance alkaline
exchange membrane fuel cells**

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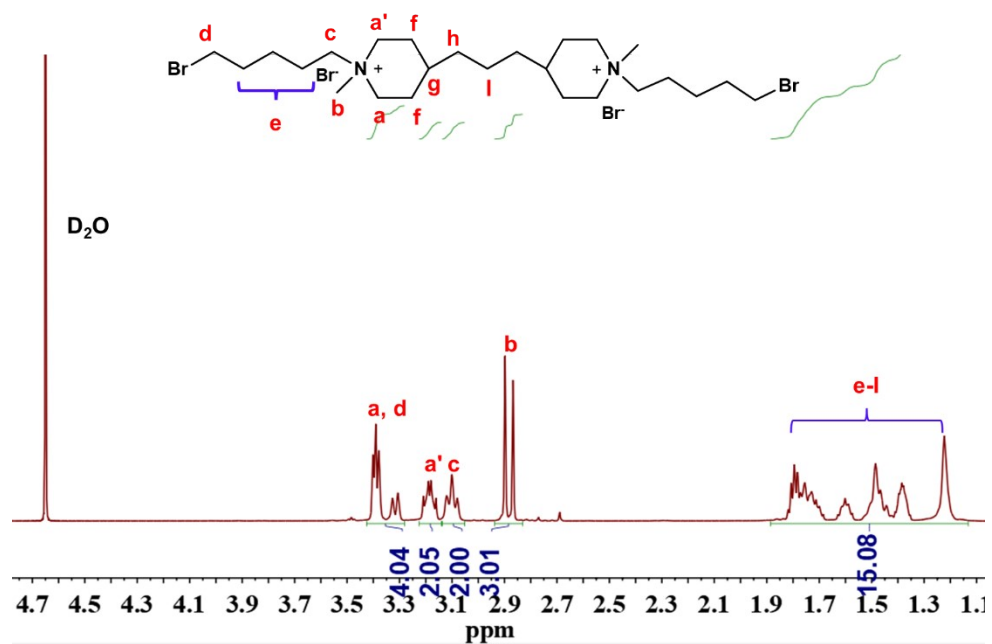


Figure S1. ^1H NMR spectrum and chemical structure of DB-DP-C5.

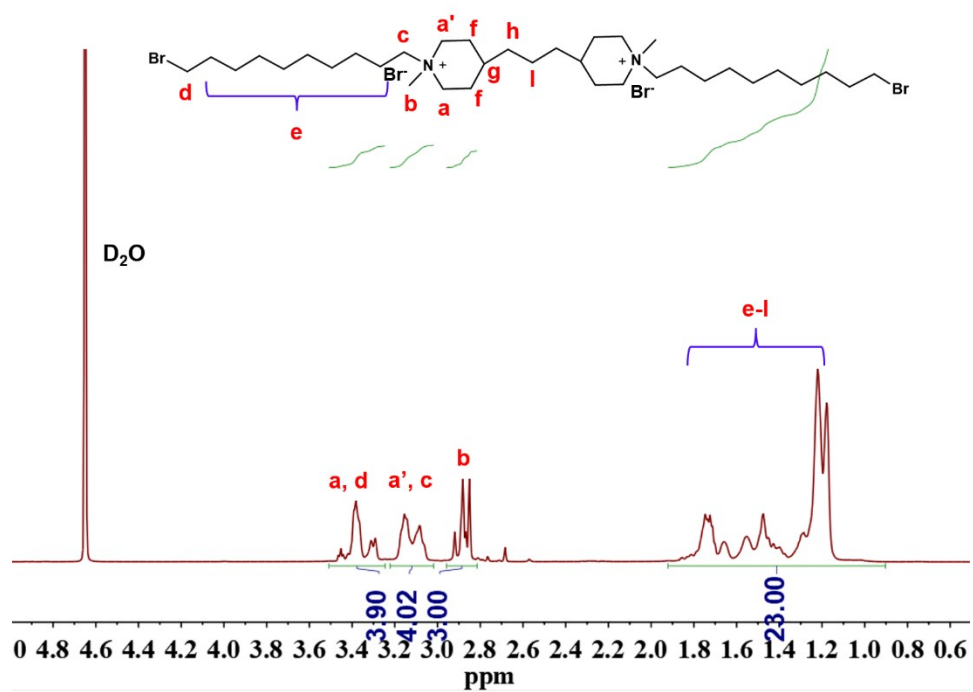


Figure S2. ¹H NMR spectrum and chemical structure of DB-DP-C10.

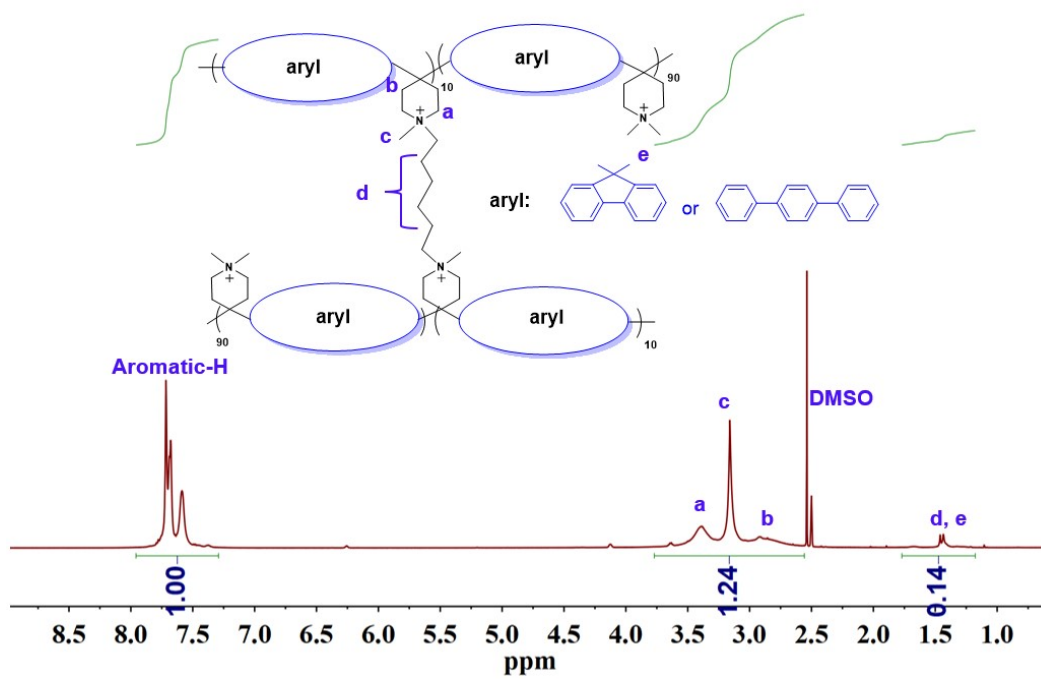


Figure S3. ¹H NMR spectrum and chemical structure of x-PFTP-10.

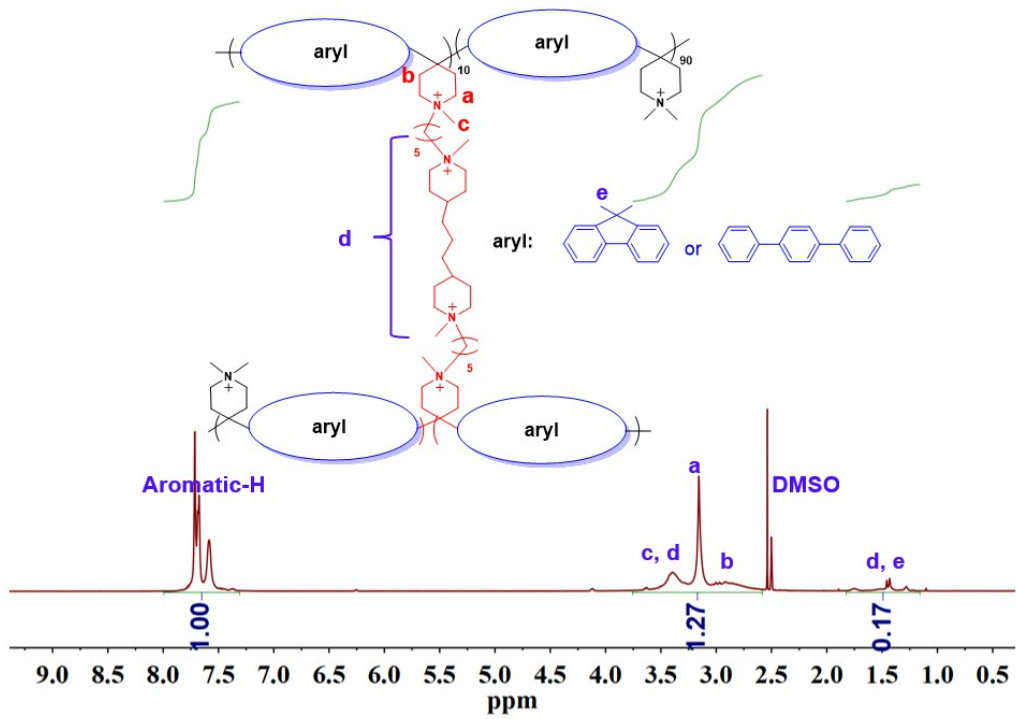


Figure S4. ¹H NMR spectrum and chemical structure of x-PFTP-DP-C5-10.

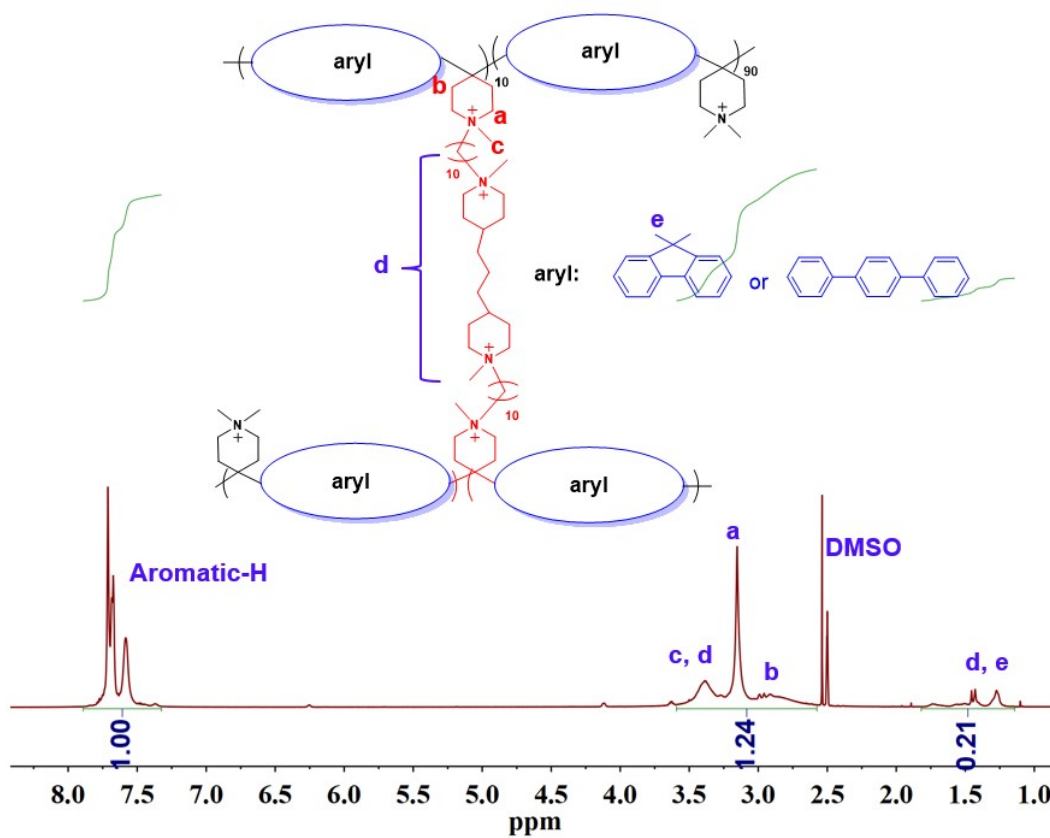


Figure S5. ¹H NMR spectrum and chemical structure of x-PFTP-DP-C10-10.

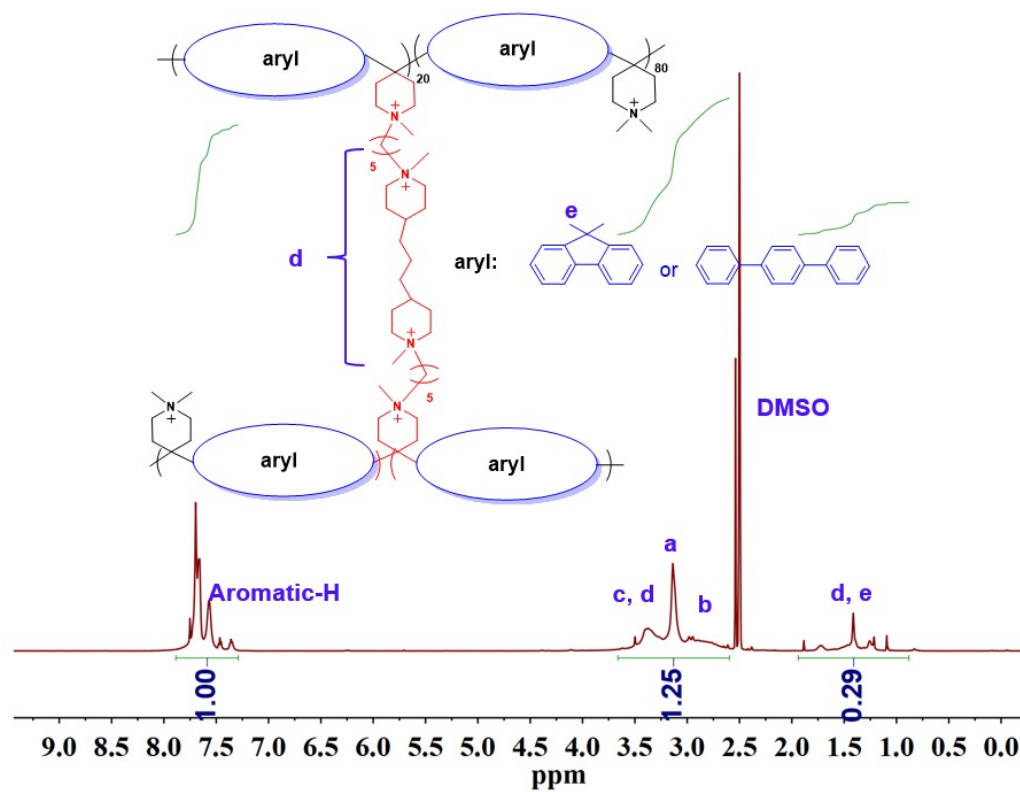


Figure S6. ¹H NMR spectrum and chemical structure of x-PFTP-DP-C5-20.

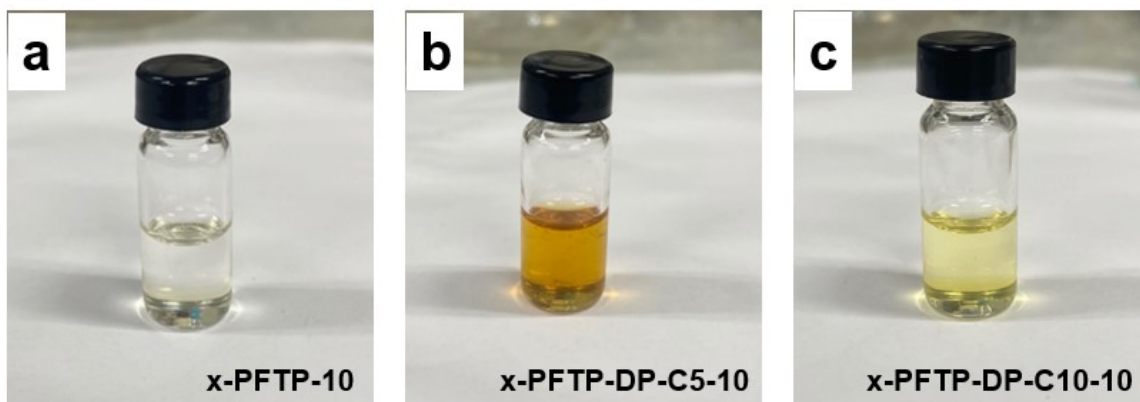


Figure S7. The photograph of transparent x-PFTP-10 and x-PFTP-DP-Cn-m polymer solution. a) x-PFTP-10, b) x-PFTP-DP-C5-10, c) x-PFTP-DP-C10-10.

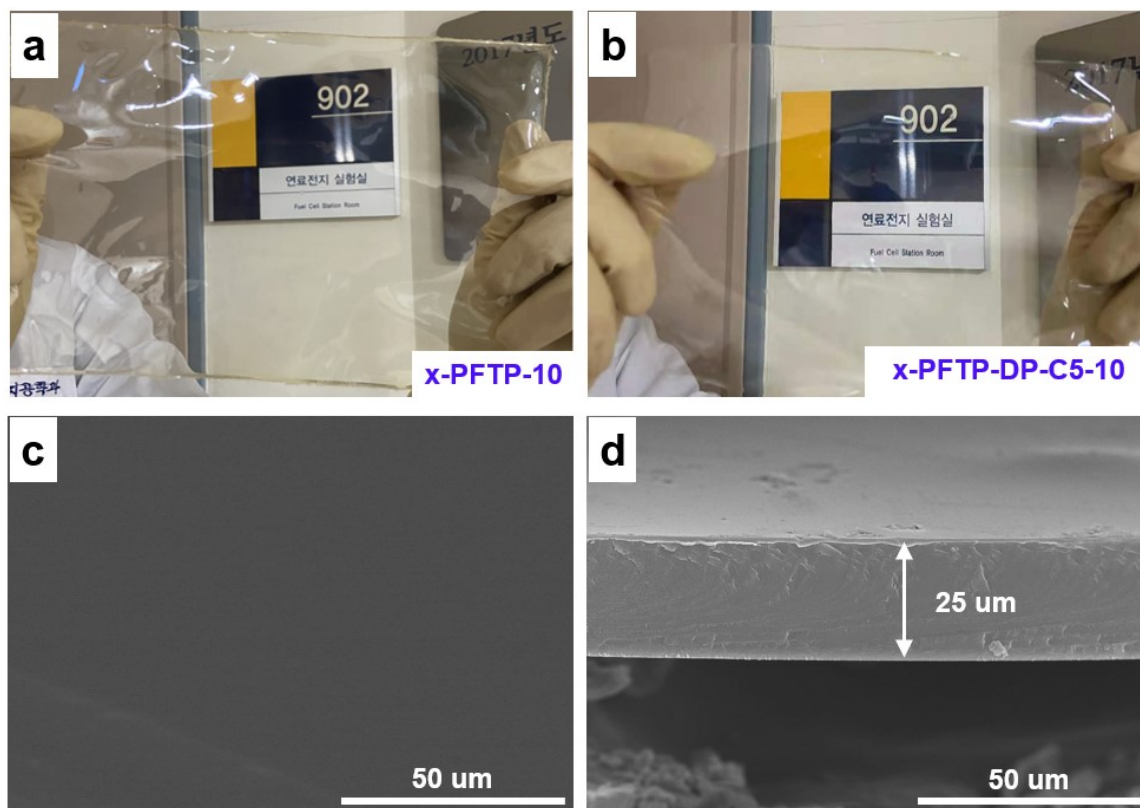


Figure S8. The photograph of transparent a) x-PFTP-10, b) x-PFTP-DP-C5-10 AEMs with a thickness of $\sim 25 \mu\text{m}$. The SEM image of c) surface, d) cross-section of x-PFTP-DP-C5-10 with $25 \mu\text{m}$.

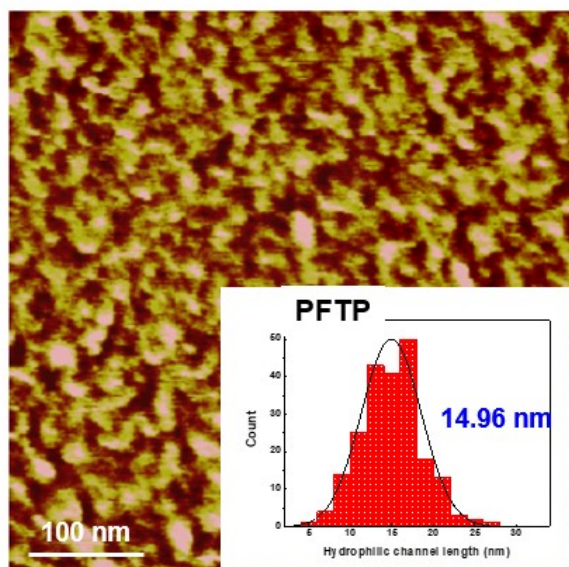


Figure S9. AFM images of PFTP in the I' form, along with the hydrophilic phase length.

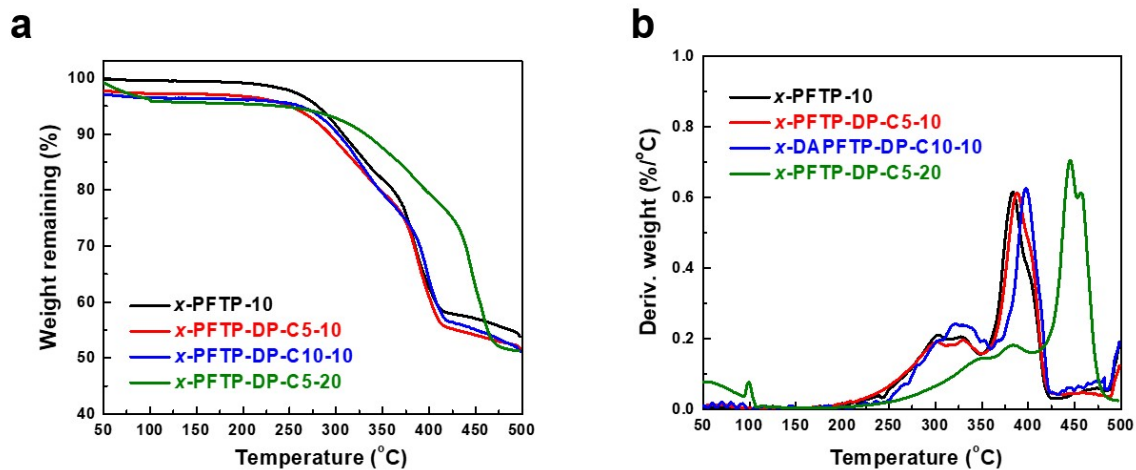


Figure S10. Thermal properties of *x*-PFTP-*m* and *x*-PFTP-DP-*C_n*-*m* AEMs.

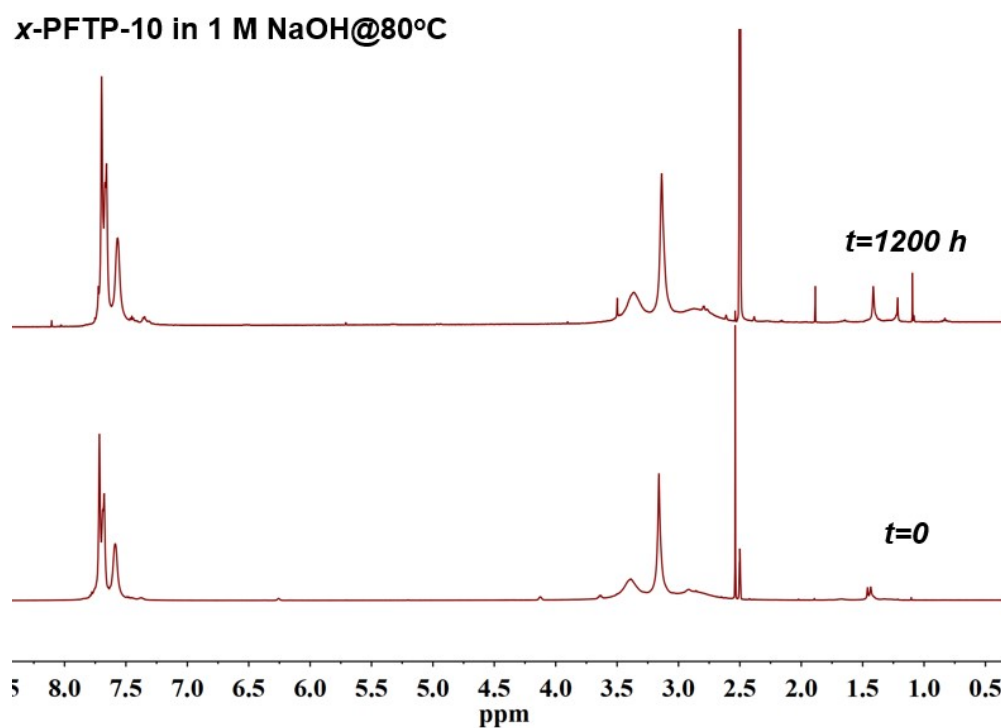


Figure S11. ¹H NMR spectrum of *x*-PFTP-10 before and after 1200 h in 1 M NaOH at 80 °C.

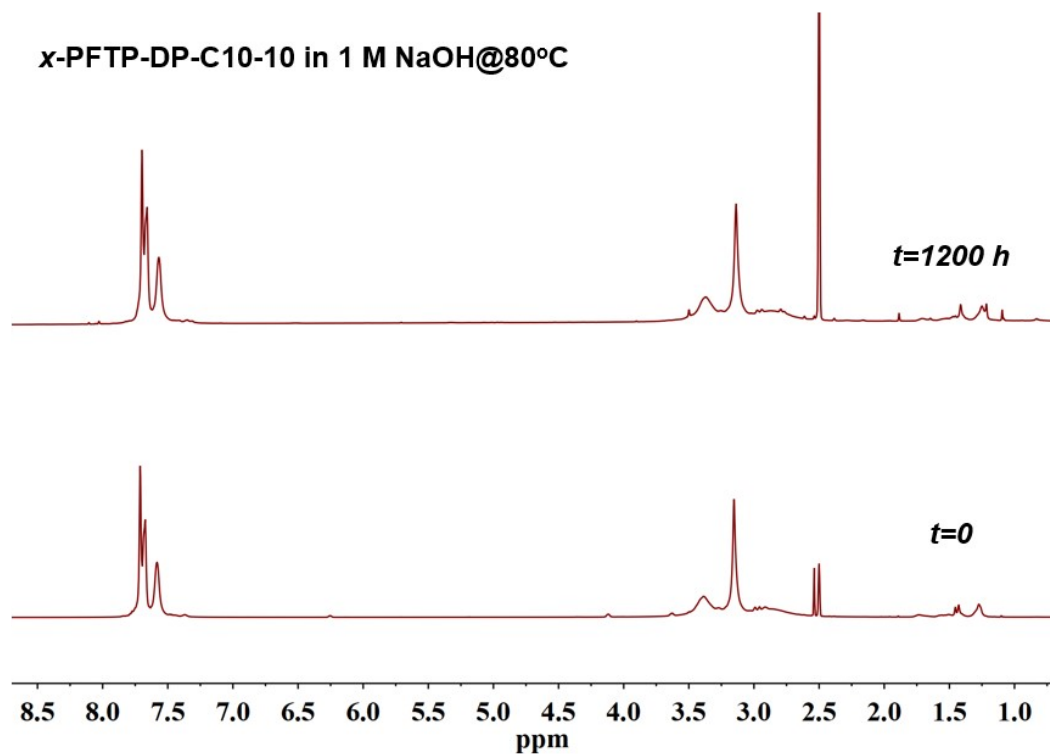


Figure S12. ^1H NMR spectrum of x-PFTP-DP-C10-10 before and after 1200 h in 1 M NaOH at 80 °C.

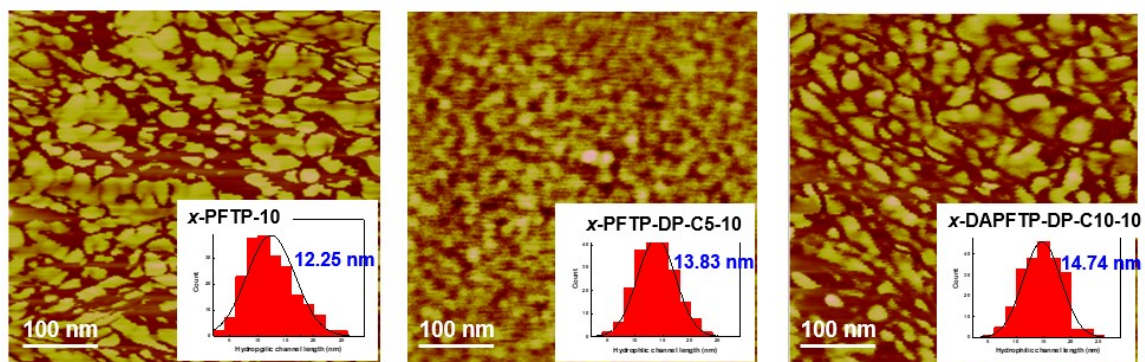


Figure S13. AFM images of x-PFTP-10 and x-PFTP-DP-C_n-m AEMs after 1200 h in 1 M NaOH at 80 °C.

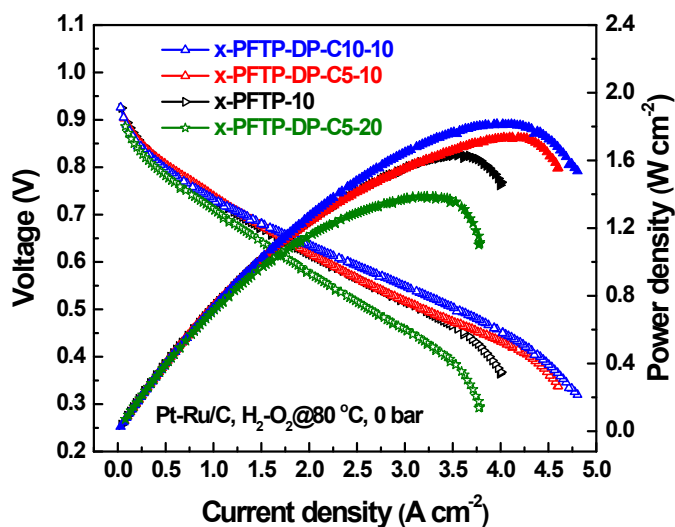


Figure S14. AEMFC performance with x-PFTP-m and x-PFTP-DP-Cn-m AEMs ($22 \pm 3 \mu\text{m}$). Testing conditions of A/C PFBP ionomers, 0.39 mg cm^{-2} Pt-Ru/C in the anode with extra carbon powder (a ratio of AEIs: total carbon: Pt-Ru = 1:2.33:2), 0.26 mg cm^{-2} Pt/C in the cathode (a ratio of AEIs: total carbon: metal = 1:2:1.33), $80 \text{ }^\circ\text{C}$, 75%/100% A/C RH, $1,000/1,000 \text{ mL min}^{-1}$ $\text{H}_2\text{-O}_2$ flow rate, 0/0 bar back pressure.

Table S1. The solubility of crosslinked PFTP AEMs in common solvents

	DMSO	DMAc	NMP	DMF	IPA
PFTP	++	++	++	++	–
x-PFTP-10	++	+	++	++	–
x-PFTP-DP-C5-10	++	+	++	++	–
x-PFTP-DP-C10-10	++	+	++	++	–
x-PFTP-DP-C5-20	+	+	+	+	–