Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information

Comb-shaped phenolphthalein-based poly (ether sulfone)s as anion exchange membranes for alkaline fuel cells

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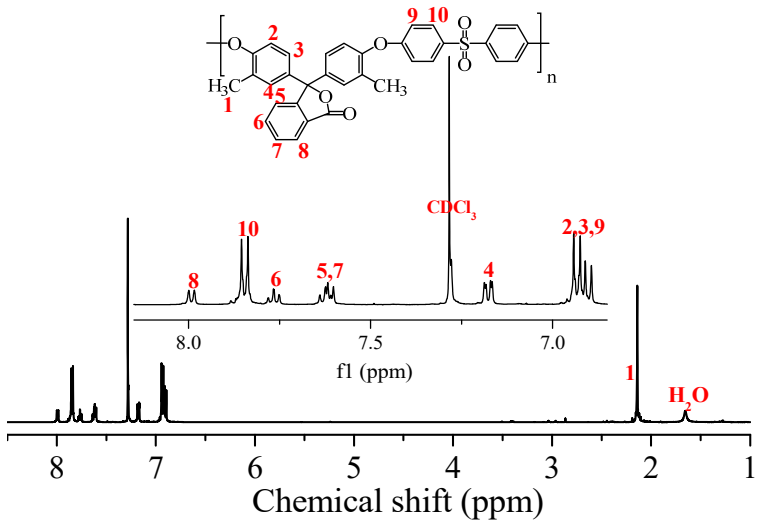

Fig. S1† The ^{1}H NMR spectra of PES in $CDCl_3$.

Table S1† Results of the bromination of PES using different amounts of NBS.

	NBS/-CH_3 [a]	DB (%) [b]	DB (%) [c]	Yield (%)
PES-B20	0.2	20	18.6	88
PES-B40	0.4	40	35.6	91
PES-B60	0.6	60	49.8	90
PES-B80	0.8	80	66.4	90
PES-B100	1.0	100	82.4	82

[a] Mole ratio; [b] theoretical value, which is calculated by the mole ratio of NBS to CH_3; [c] experimental value, which is calculated from ^{1}H NMR spectrum.

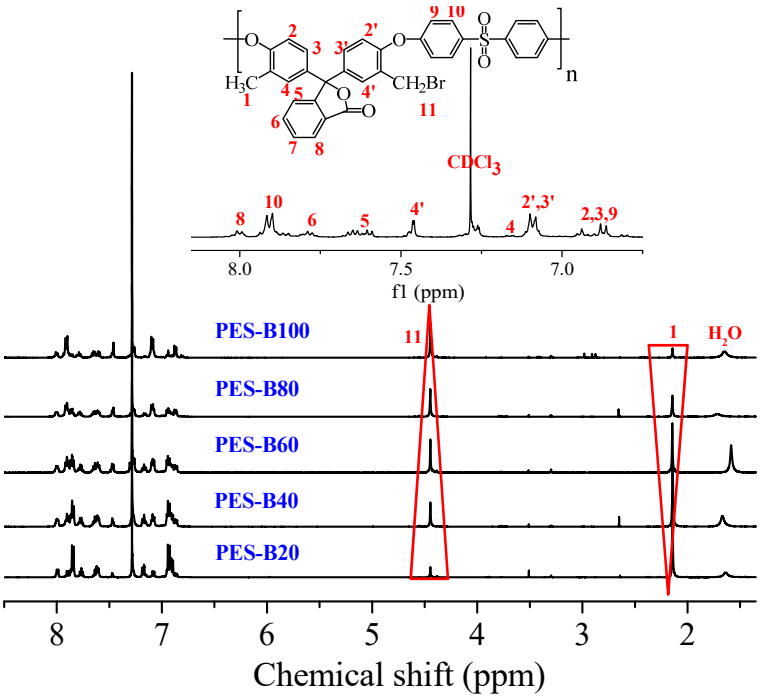

Fig. S2† The ^{1}H NMR spectrum of PES-Bx in $CDCl_3$.

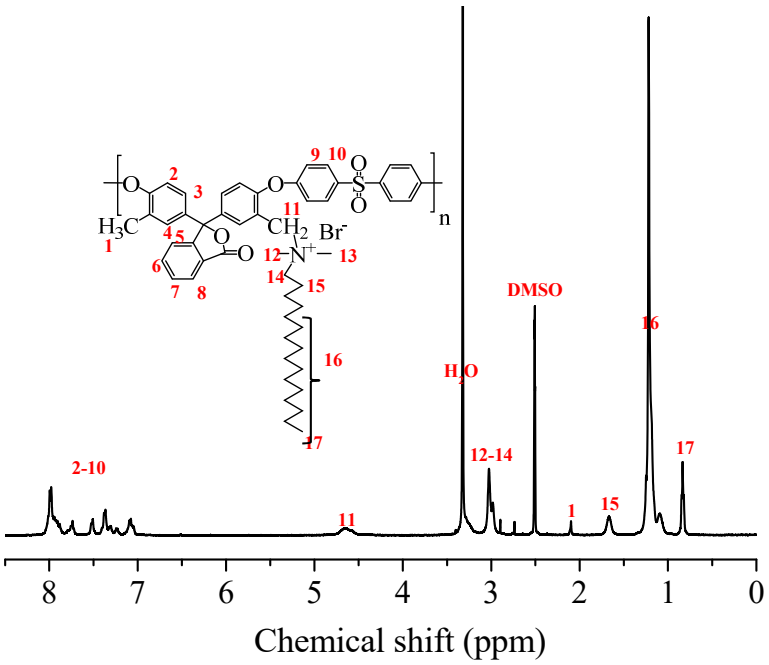

Fig. S3† The ^{1}H NMR spectrum of PES-B100-C16 in the bromine form in DMSO-d_6.

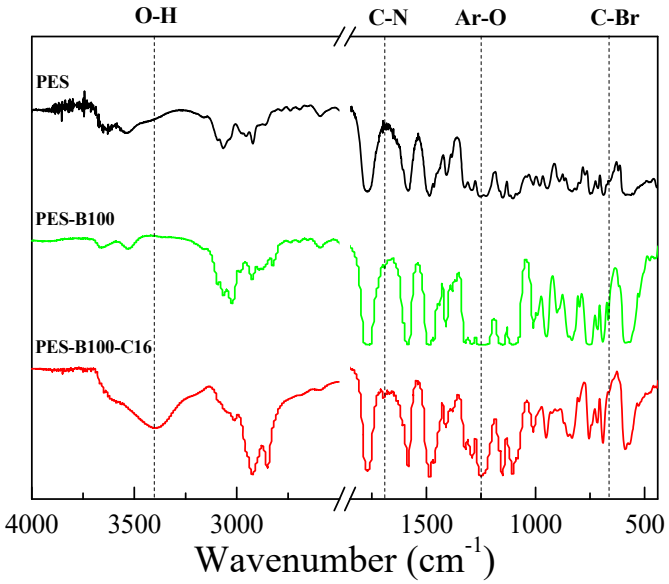

Fig. S4† The FT-IR spectra of PES, PES-B100, and PES-B100-C16.

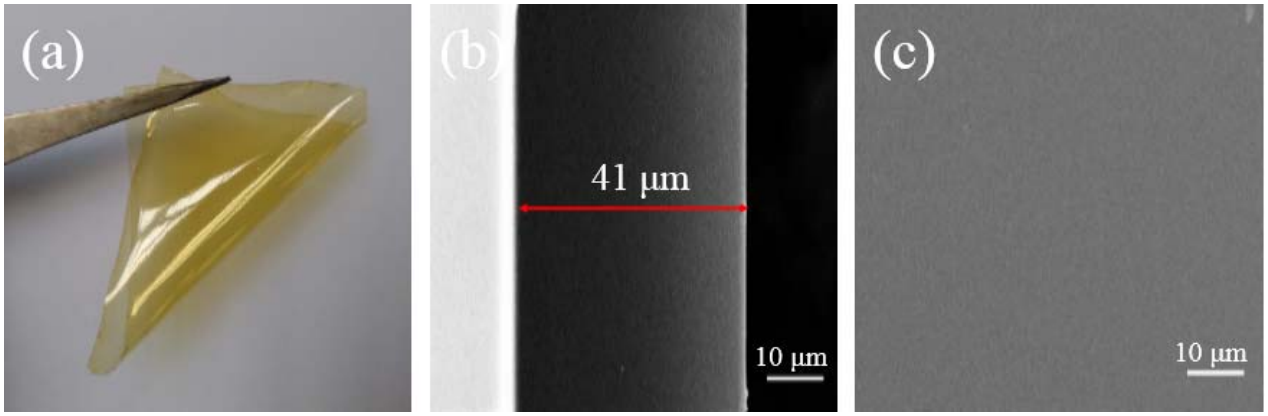

Fig. S5† (a) Digital photo and SEM images: (b) cross-section (c) surface of the PES-B100-C16 membrane

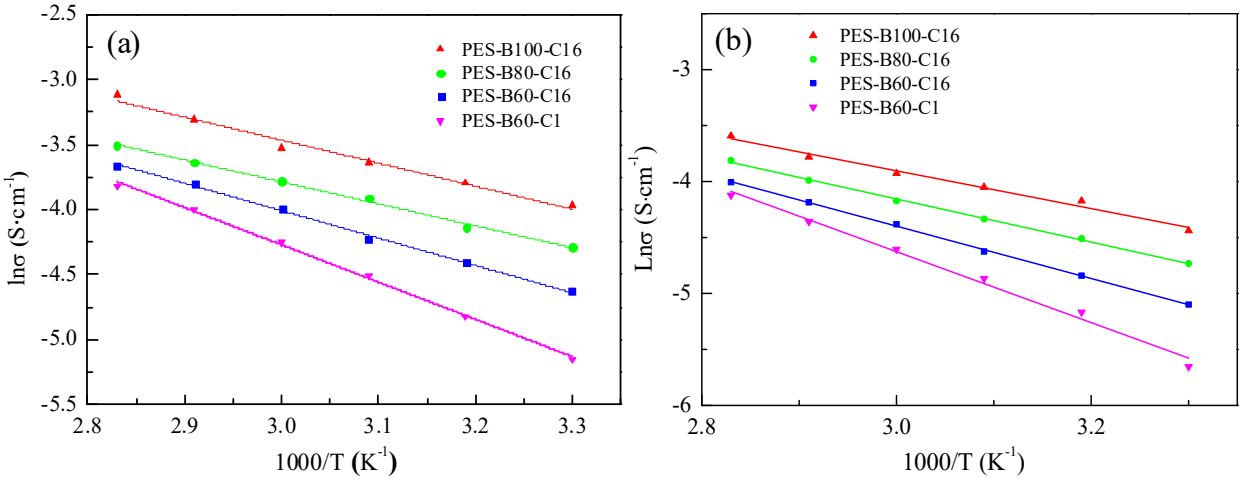

Fig. S6† Arrhenius plots for the (a) in-plane and (b) through-plane conductivity of the AEMs

Table S2† Solubility of comb-shaped PES-Bx-C16 membranes in commonly used solvents.

	DMF	DMAc	DMSO	NMP	methanol	ethanol	n-propanol
PES	+	+	+	+	-	-	-
PES-Bx[a]	+	+	+	+	-	-	-
PES-B60-C16	+	+	-	+	-	-	-
PES-B80-C16	+	+	-	+	-	-	-
PES-B100-C16	+	+	-	+	-	-	-

+ Soluble; - insoluble; [a] x=60, 80 and 100. PES-Bx-C16 is in hydroxide form. All of above were measured at room temperature.

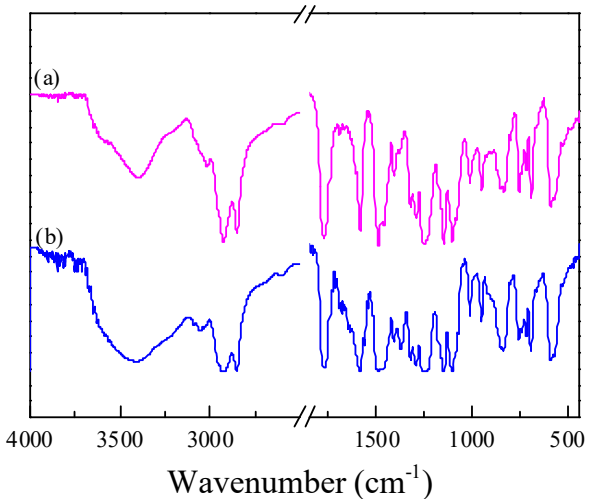

Fig. S7† The FT-IR spectra of PES-B100-C16 (a) before and (b) after alkaline stability test

Table S3† Permeability of H_2 and O_2 through PES-B100-C16 in hydroxide form at 50 °C.

	Gas permeability (cm^3 cm cm^{-2} s^{-1} cm Hg^{-1})	
	H_2	O_2
PES-B100-C16	4.2×10^{-9}	3.2×10^{-10}

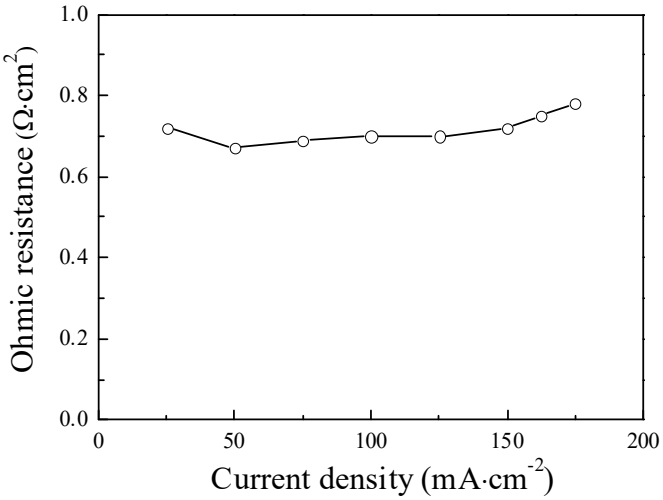

Fig. S8† Ohmic resistance of MEA using the PES-B100-C16 membrane