Electronic supplementary information

Poly(*p*-phenylene)s tethered with oligo(ethylene oxide): synthesis by Yamamoto polymerization and properties as solid polymer electrolytes

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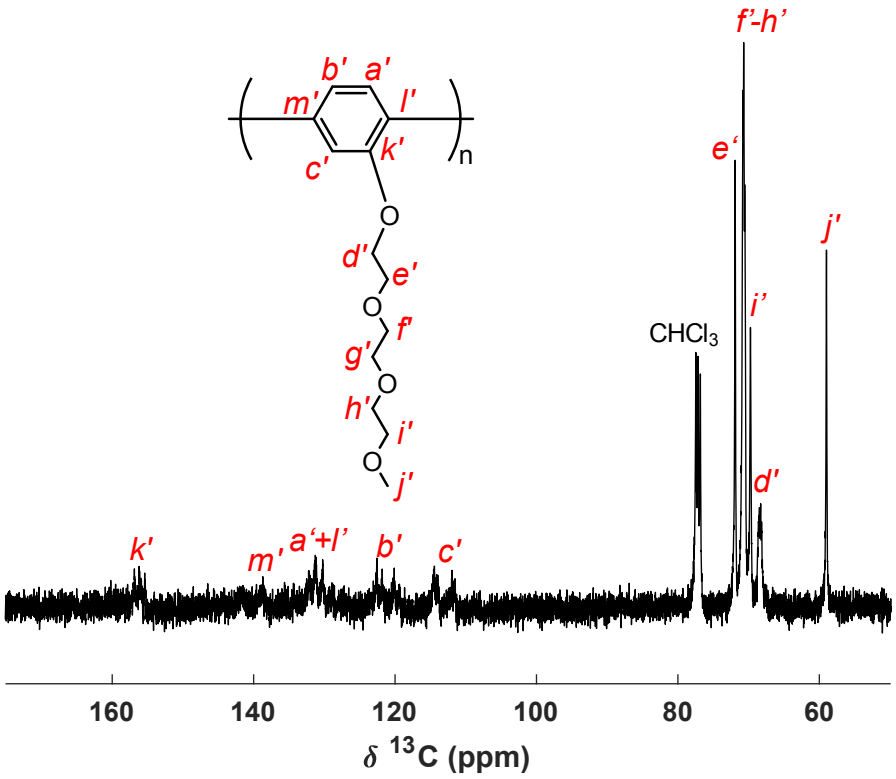

Fig. S1. ^{13}C NMR spectrum of P(*p*P-EO$_3$) recorded using a $CHCl_3$ solution.

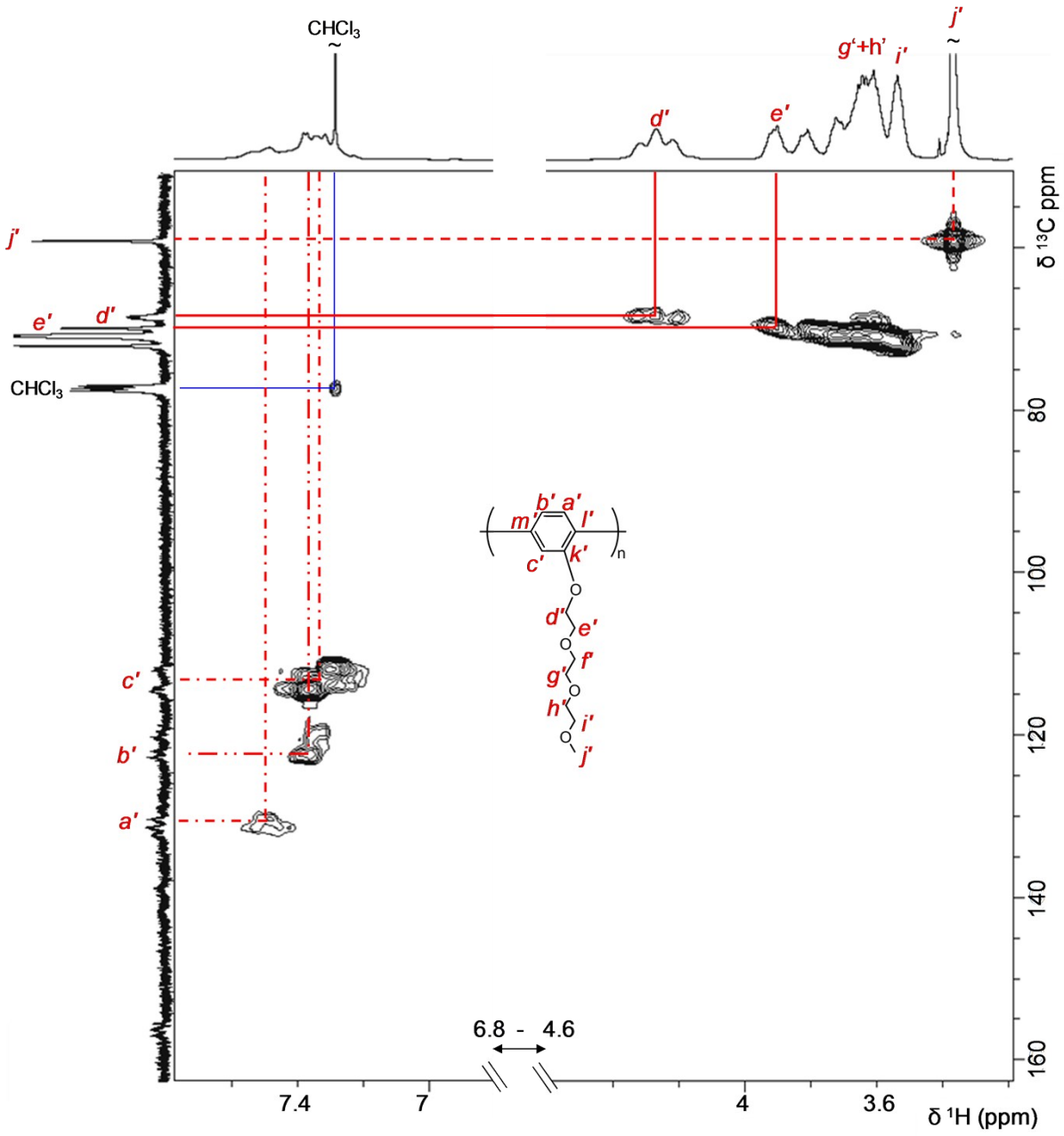

Fig. S2. HMQC NMR spectrum of P(*p*P-EO$_3$) illustrating coupling between carbons and the protons that are directly attached to the corresponding carbon. Selected signals are marked in the figure. Note that the ^{1}H NMR spectrum has been cropped and the correlation signals at δ ^{1}H > 6.8 ppm have been more magnified compared to the signals at δ ^{1}H < 4.6 ppm, for clarity.

Table S1. Thermal properties of the polymer electrolyte membranes obtained by DSC.[a]

Polymer	[EO]/[Li]	$T_{g,h}$ [b] (°C)	$T_{ODT,1}$ [c] (°C)	$T_{ODT,2}$ [d] (°C)	ΔH_{ODT} [e] (J g^{-1})	$T_{g,c}$ [f] (°C)	$T_{DOT,1}$ [g] (°C)	$T_{DOT,2}$ [h] (°C)	ΔH_{DOT} [i] (J g^{-1})
P(*p*P-EO$_2$)	No salt	-	66	172	16		70	155	14
P(*p*P-EO$_3$)	No salt	-48	55	168	11	-45	70	161	11
	40	-35	80	197	15	-37	68	183	15
	30	-31	82	197	12	-33	87	188	8
	20	-21	81	197	8	-27	76	144	3
	10	15	-	-	-	13	-	-	-
P(*p*P-EO$_4$)	No salt	-54	40	161	14		54	151	10
	40	-42	49	197	15	-44	74	186	8
	30	-38	66	197	13	-38	80	172	4
	20	-30	75	197	9	-30	87	178	3
	10	-11	78	197	7	-20	-	-	-

[a] Scan rate: 10 °C min^{-1} under N_2, [b] T_g obtained during the second heating cycle, [c] onset of ODT, [d] end of ODT, [e] Enthalpy of ODT, [f] T_g obtained during the cooling cycle, [g] End of DOT, [h] Onset of DOT, [i] Enthalpy of DOT.

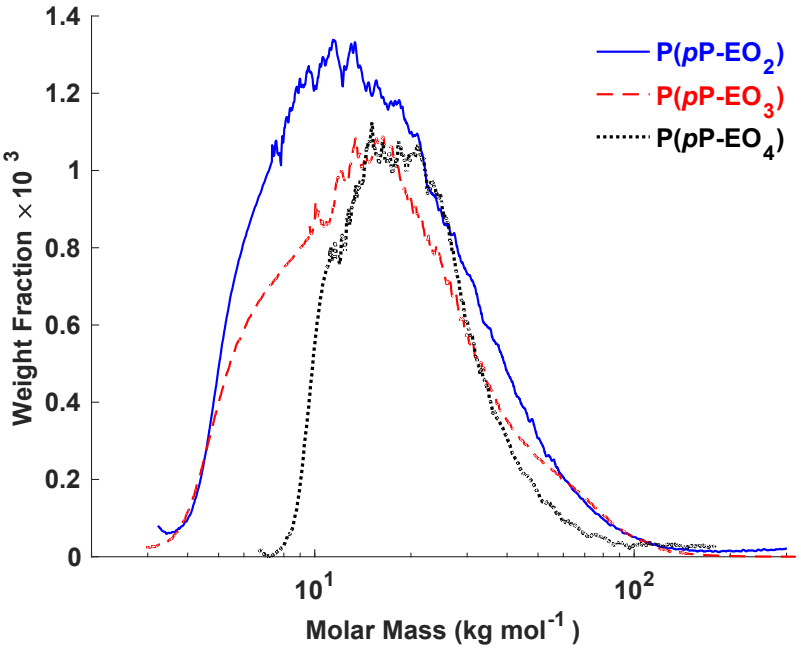

Fig. S3. Molar mass distribution of the P(*p*P-EO*x*) samples, calculated from data obtained by SEC analysis using a triple detector setup.

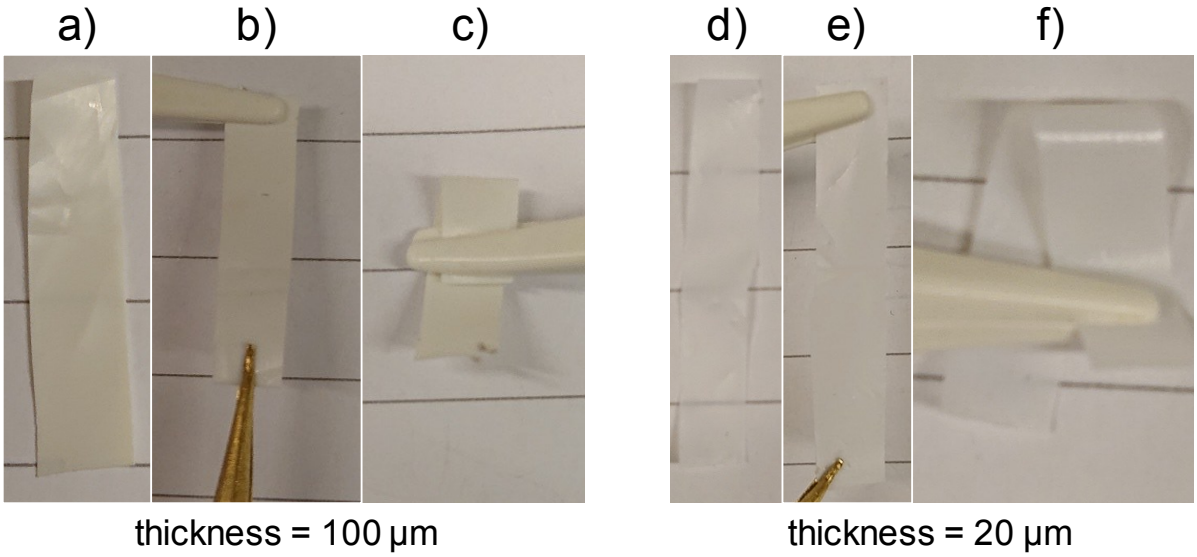

Fig. S4. Strips of films of P(*p*P-EO_2) cast from $CHCl_3$ solutions of the polymer with thicknesses of 100 and 20 µm. The 100 µm thick films were opaque and white **(a)** and could be gently stretched **(b)** and folded **(c)**. The 20 µm thick films were translucent **(d)** and still retained some strength **(e)** and flexibility **(f)**.

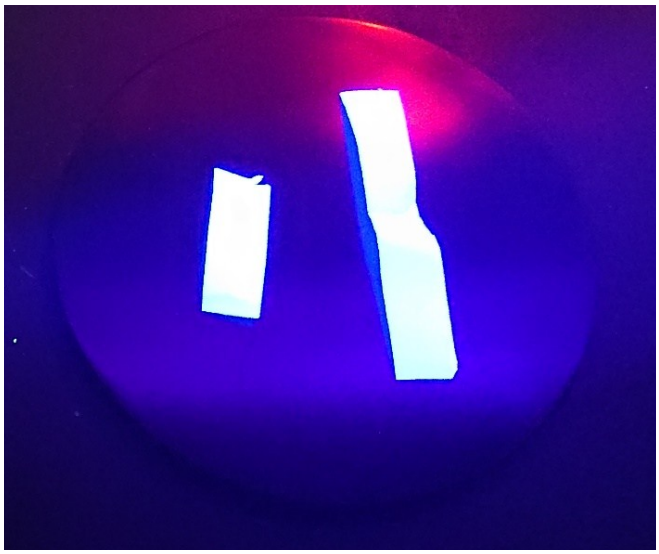

Fig. S5. Film strips of P(*p*P-EO_2) with the thicknesses 100 (left) and 20 (right) µm under UV irradiation. The conjugated structure the polymer gave rise to strong fluorescence.

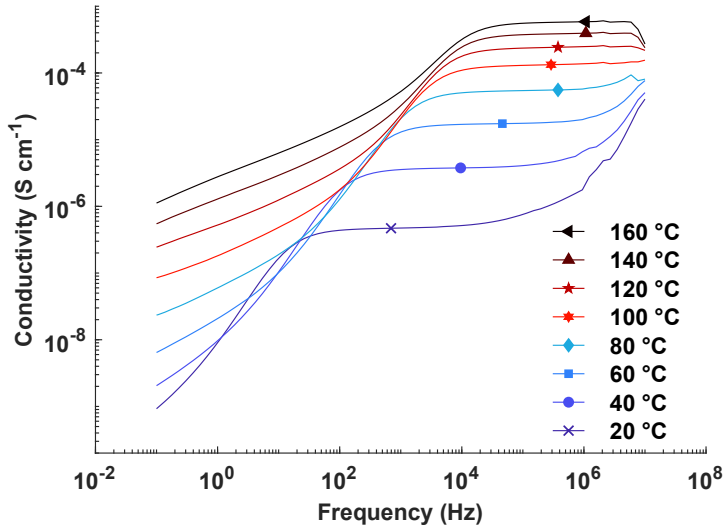

Fig. S6. Ionic conductivity of P(*p*P-EO_3)-30 as a function of the ac frequency recorded during the second heating cycle in the EIS measurements. The dc conductivity values were obtained by extrapolation from the respective plateaus (marked by symbols).

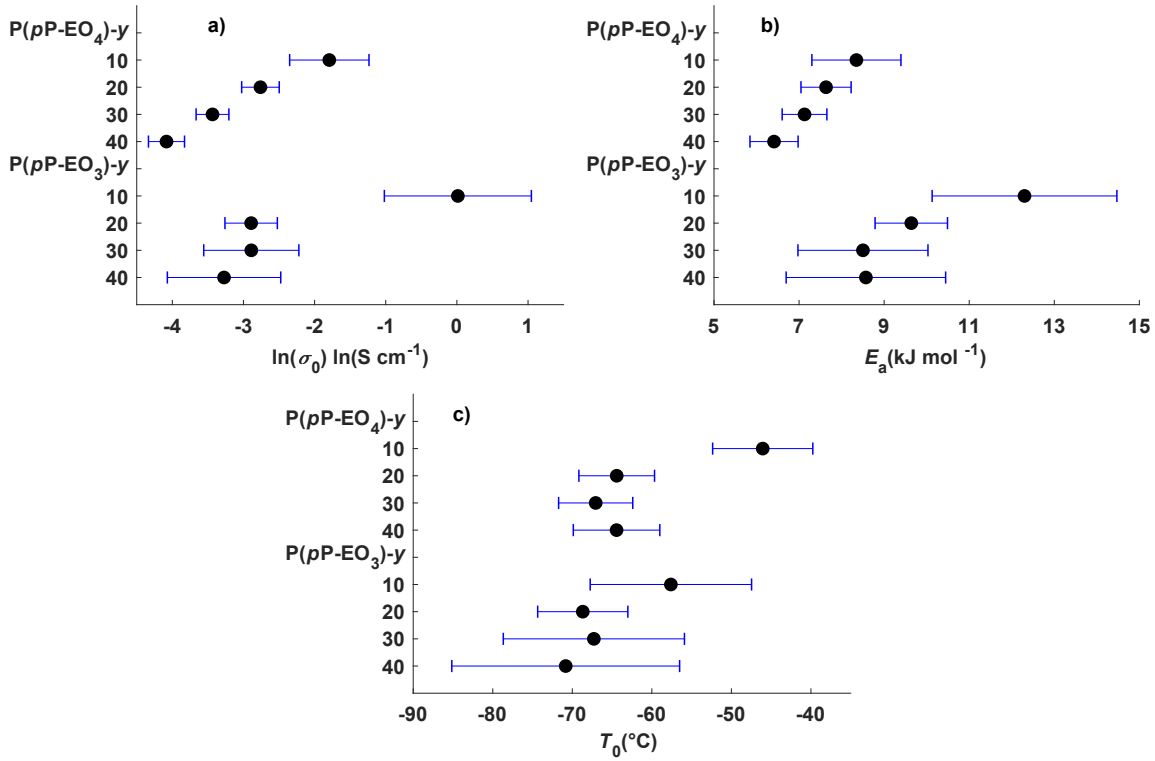

Fig. S7. Graphical representation of the parameters obtained by fitting EIS data to the VTF equation, (including estimations of the 95% confidence intervals).