

## Electronic Supplementary Information

### **Chemical stability of poly(phenylene oxide)-based ionomers in anion exchange-membrane fuel cell environment**

Sapir Willdorf-Cohen,<sup>‡a</sup> Abhishek N. Mondal,<sup>‡a</sup> Dario R. Dekel<sup>\*a,c</sup> and Charles E. Diesendruck<sup>\*b,c</sup>

<sup>a</sup> The Wolfson Department of Chemical Engineering, Technion-Israel Institute of Technology, Haifa 3200003, Israel. E-mail: [dario@technion.ac.il](mailto:dario@technion.ac.il)

<sup>b</sup> Schulich Faculty of Chemistry, Technion-Israel Institute of Technology, Haifa 3200008, Israel. [charles@technion.ac.il](mailto:charles@technion.ac.il)

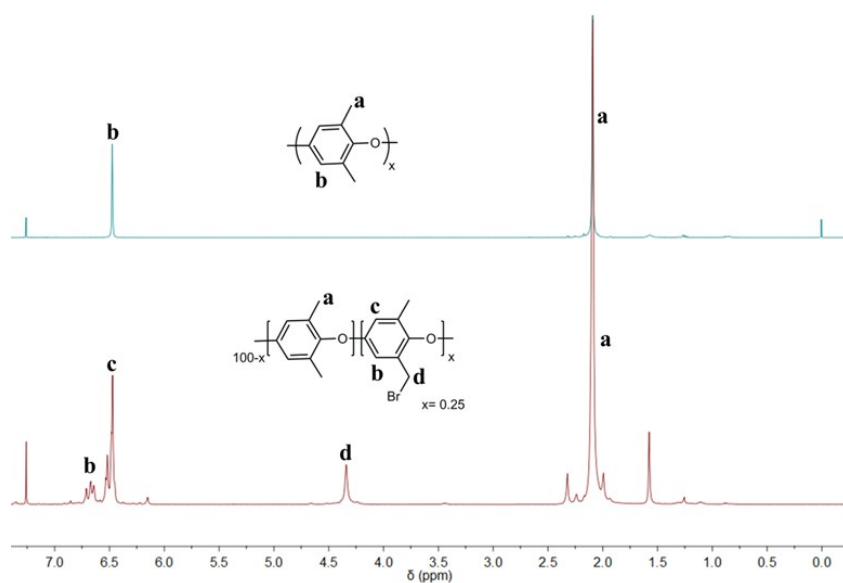
<sup>c</sup> The Nancy & Stephan Grand Technion Energy Program (GTEP), Technion-Israel Institute of Technology, Haifa 3200003, Israel.

<sup>‡</sup> Sapir Willdorf-Cohen and Abhishek N. Mondal contribute equally to the work.

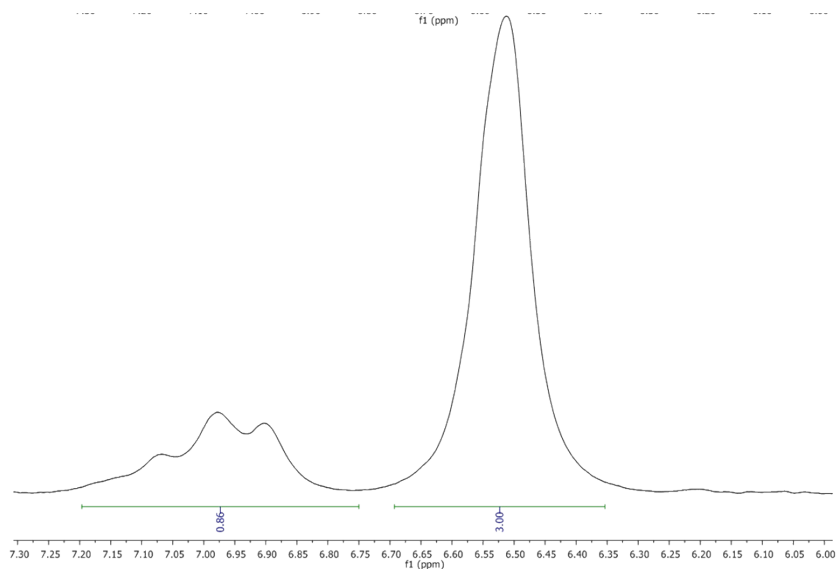
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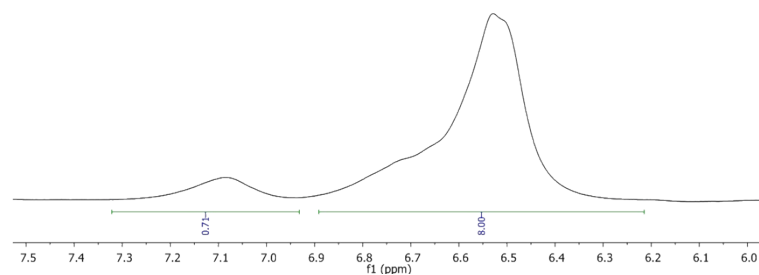
## I. NMRs



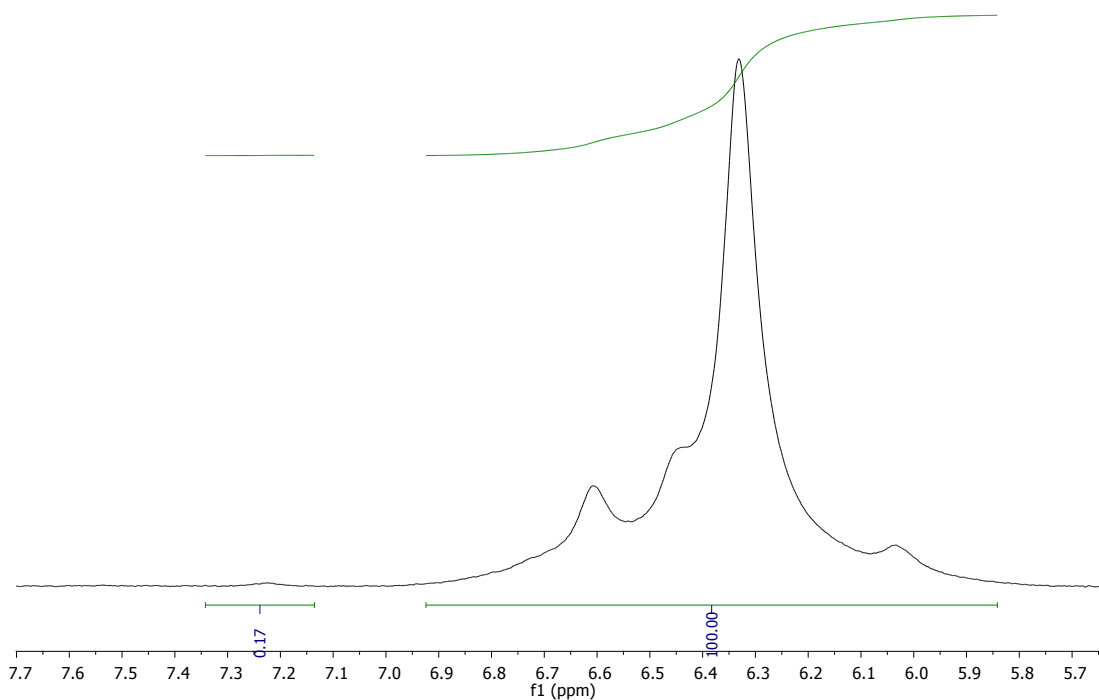
**Fig. S1** Comparison of <sup>1</sup>H NMR spectra between synthesized Br-PPO and parent PPO.



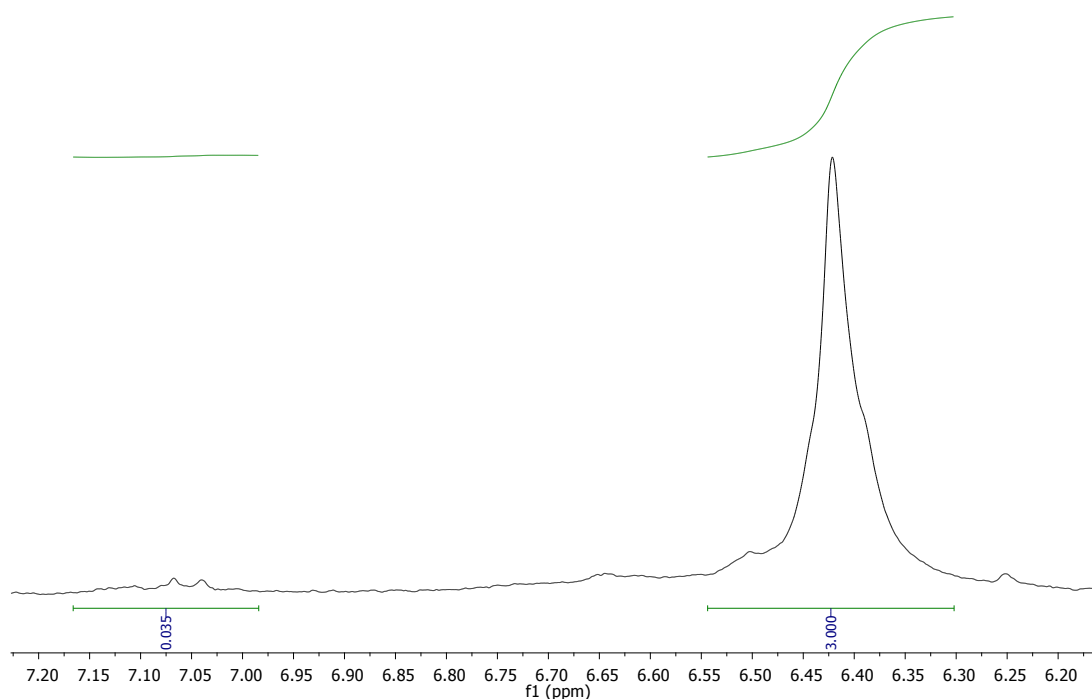
**Fig. S2** 25% PPO-TMA after 9 minutes showing 9% degradation at  $\lambda=0$  in 0.06 M OH<sup>-</sup>. Peak at 6.5 ppm: unsubstituted phenylene-oxide rings, used as standard; 7.1 ppm – aromatic hydrogens on TMA containing rings.



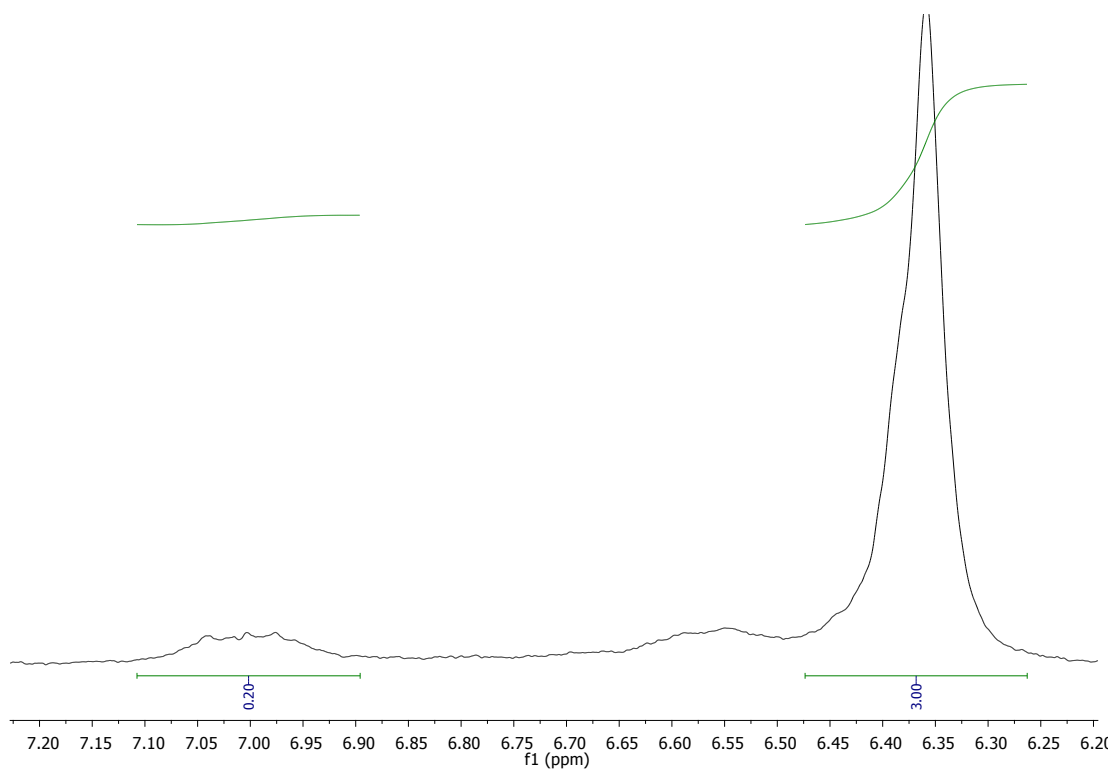
**Fig. S3** 11% PPO-TEA after 9 hours showing 14% degradation at  $\lambda=0$  in 0.06 M OH<sup>-</sup>. Peak at 6.5 ppm: unsubstituted phenylene-oxide rings, used as standard; 7.1 ppm – aromatic hydrogens on TEA containing rings.



**Fig. S4** 11% PPO-TEA after 24 hours showing 98% degradation at  $\lambda=16$  in 0.06 M OH<sup>-</sup>, 80 °C. Peak at 6.5 ppm: unsubstituted phenylene-oxide rings, used as standard; 7.1 ppm – aromatic hydrogens on TEA containing rings.



**Fig. S5** 25% PPO-TMA after 7 days hours showing 96.3% degradation at  $\lambda=0$  in 0.06 M OH<sup>-</sup>, 80 °C. Peak at 6.4 ppm: unsubstituted phenylene-oxide rings, used as standard; 7.05 ppm – aromatic hydrogens on TEA containing rings.



**Fig. S8** 25% PPO-TMA after 7 days hours showing 78.8% degradation at  $\lambda=16$  in 0.06 M  $\text{OH}^-$ , 80 °C. Peak at 6.4 ppm: unsubstituted phenylene-oxide rings, used as standard; 7.05 ppm – aromatic hydrogens on TEA containing rings.

## II. Numerical data for kinetics

**Table S1.** Kinetic data for 25% PPO-TMA at  $\lambda=0$  in 0.06 M OH<sup>-</sup>.

Time [h]	Integration 7.1 ppm	% remaining	ln(% remaining)
0	87	100.0000	4.6052
0.1500	87	100.0000	4.6052
0.3756	83	95.4023	4.5581
0.6678	84	96.5517	4.5701
0.9600	84	96.5517	4.5701
1.2522	85	97.7011	4.5819
1.5444	85	97.7011	4.5819
1.8367	84	96.5517	4.5701
2.1289	84	96.5517	4.5701
2.4211	84	96.5517	4.5701
2.7133	84	96.5517	4.5701
3.0056	83	95.4023	4.5581
3.2978	83	95.4023	4.5581
3.5900	83	95.4023	4.5581
3.8822	83	95.4023	4.5581
4.1744	83	95.4023	4.5581
4.4667	82	94.2529	4.5460
4.7589	83	95.4023	4.5581
5.0511	82	94.2529	4.5460
5.3433	82	94.2529	4.5460
5.6356	82	94.2529	4.5460
5.9278	81	93.1034	4.5337
6.2200	81	93.1034	4.5337
6.5122	81	93.1034	4.5337
6.8044	81	93.1034	4.5337
7.0967	81	93.1034	4.5337
7.3889	81	93.1034	4.5337
7.6811	80	91.9540	4.5213
7.9733	81	93.1034	4.5337
8.2656	80	91.9540	4.5213
8.5578	80	91.9540	4.5213
8.8500	80	91.9540	4.5213
9.1422	80	91.9540	4.5213
9.4344	80	91.9540	4.5213
9.7267	79	90.8046	4.5087
10.0189	79	90.8046	4.5087
10.3111	79	90.8046	4.5087
10.6033	79	90.8046	4.5087
10.8956	79	90.8046	4.5087

**Table S2.** Kinetic data for 25% PPO-TMA at  $\lambda=4$  in 0.06 M OH<sup>-</sup>.

Time [h]	Integration 7.1 ppm	% remaining	ln(% remaining)
0	1	100	4.6052
73	0.99	99	4.5951
189	0.94	94	4.5433
283	0.95	95	4.5539
310	0.94	94	4.5433
406	0.94	94	4.5433
646	0.92	92	4.5218

**Table S3.** Kinetic data for 25% PPO-TMA at  $\lambda=8$  in 0.06 M OH<sup>-</sup>.

time	aromatic:7.2ppm	%remaining	ln(%remaining)
0	0.99	100	4.6052
63	1	100	4.6052
120	1	100	4.6052
165	1	100	4.6052
230	1	100	4.6052
302	1	100	4.6052
402	1	100	4.6052
518	1	100	4.6052
612	1	100	4.6052
639	1	100	4.6052
735	1	100	4.6052
975	0.99	99	4.5951

**Table S4.** Kinetic data for 11% PPO-TEA at  $\lambda=0$  in 0.06 M OH<sup>-</sup>.

Time [h]	Integration 7.1 ppm	% remaining	ln(% remaining)
0.0000	1	100.0000	4.6052
0.2167	0.78	93.9759	4.5430
0.8211	0.83	100.0000	4.6052
1.4256	0.79	95.1807	4.5558
2.0300	0.78	93.9759	4.5430
2.6344	0.77	92.7711	4.5301
3.2389	0.76	91.5663	4.5171
3.8433	0.75	90.3614	4.5038
4.4478	0.74	89.1566	4.4904
5.0522	0.73	87.9518	4.4768
5.6567	0.73	87.9518	4.4768
6.2611	0.72	86.7470	4.4630
6.8656	0.72	86.7470	4.4630
7.4700	0.71	85.5422	4.4490
8.0744	0.71	85.5422	4.4490
8.6789	0.71	85.5422	4.4490

9.2833	0.71	4.4490	4.4490
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**Table S5.** Kinetic data for 11% PPO-TEA at  $\lambda=4$  in 0.06 M OH<sup>-</sup>.

Time [h]	Integration 7.1 ppm	% remaining	ln(% remaining)
0.0000	1	100	4.6052
0.1167	1	100	4.6052
0.2589	0.99	99	4.5951
0.6178	1	100	4.6052
0.9767	1	100	4.6052
1.3356	1	100	4.6052
1.6944	1	100	4.6052
2.0533	0.99	99	4.5951
2.4122	0.99	99	4.5951
2.7711	0.99	99	4.5951
3.1300	1.01	101	4.6151
3.4889	1	100	4.6052
3.8478	0.98	98	4.5850
4.2067	0.98	98	4.5850
4.5656	0.96	96	4.5643
4.9244	0.98	98	4.5850
5.2833	0.95	95	4.5539
5.6422	0.97	97	4.5747
6.0011	0.95	95	4.5539
6.3600	0.95	95	4.5539
6.7189	0.94	94	4.5433
7.0778	0.94	94	4.5433
7.4367	0.93	93	4.5326
7.7956	0.93	93	4.5326
8.1544	0.94	94	4.5433
8.5133	0.91	91	4.5109
8.8722	0.9	90	4.4998
9.2311	0.93	93	4.5326
9.5900	0.91	91	4.5109
9.9489	0.9	90	4.4998
10.3078	0.89	89	4.4886
10.6667	0.88	88	4.4773
11.0256	0.87	87	4.4659
11.3844	0.89	89	4.4886
11.7433	0.86	86	4.4543
12.1022	0.85	85	4.4427

**Table S6.** Kinetic data for 11% PPO-TEA at  $\lambda=8$  in 0.06 M OH<sup>-</sup>.

Time [h]	Integration 7.1 ppm	% remaining	ln(% remaining)
0	1	100	4.6052
0.1667	1	100	4.6052
1.0267	0.94	100	4.6052
1.3856	0.94	100	4.6052
1.7444	0.94	100	4.6052
2.1033	0.94	100	4.6052
2.4622	0.93	98.9362	4.5945
2.8211	0.93	98.9362	4.5945
3.1800	0.9	95.7447	4.5617
3.5389	0.93	98.9362	4.5945
3.8978	0.92	97.8723	4.5837
4.2567	0.92	97.8723	4.5837
4.6156	0.93	98.9362	4.5945
4.9744	0.93	98.9362	4.5945
5.3333	0.93	98.9362	4.5945
5.6922	0.92	97.8723	4.5837
6.0511	0.94	100	4.6052
6.4100	0.94	100	4.6052
6.7689	0.94	100	4.6052
7.1278	0.93	98.9362	4.5945
7.4867	0.92	97.8723	4.5837
7.8456	0.93	98.9362	4.5945
8.2044	0.92	97.8723	4.5837
8.5633	0.92	97.8723	4.5837
8.9222	0.93	98.9362	4.5945
9.2811	0.93	98.9362	4.5945
9.6400	0.93	98.9362	4.5945
9.9989	0.91	96.8085	4.5727
10.3578	0.93	98.9362	4.5945
10.7167	0.93	98.9362	4.5945
11.0756	0.91	96.8085	4.5727
11.4344	0.91	96.8085	4.5727
11.7933	0.9	95.7447	4.5617