Electronic Supplementary Material (ESI) for Polymer Chemistry
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Supplementary Information

Sub-10 nm Domains in High-Performance Polyetherimides

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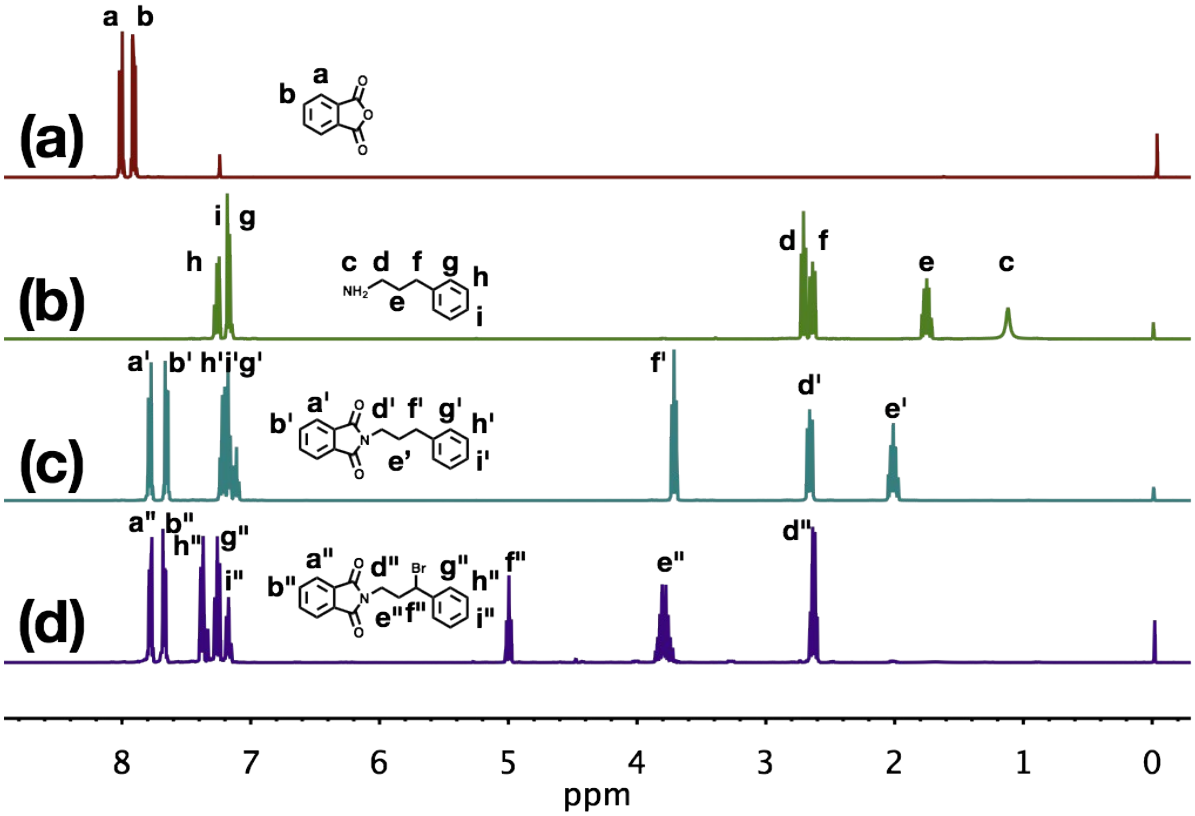

Fig. S1 ^{1}H NMR spectra of (a) phthalic anhydride, (b) 3-phenylpropylamine, (c) 2-(3-phenylpropyl)isoindoline-1,3-dione, (d) 2-(3-bromo-3-phenylpropyl)isoindoline-1,3-dione (BPI). The two peaks at 0.00 ppm and 7.26 ppm are from tetramethylsilane and chloroform, respectively. In comparison to peaks f' and e' in (c), f'' and e'' in (d) shifts downfield, and the integration of f'' reduces to 1, which indicates the successful bromination.

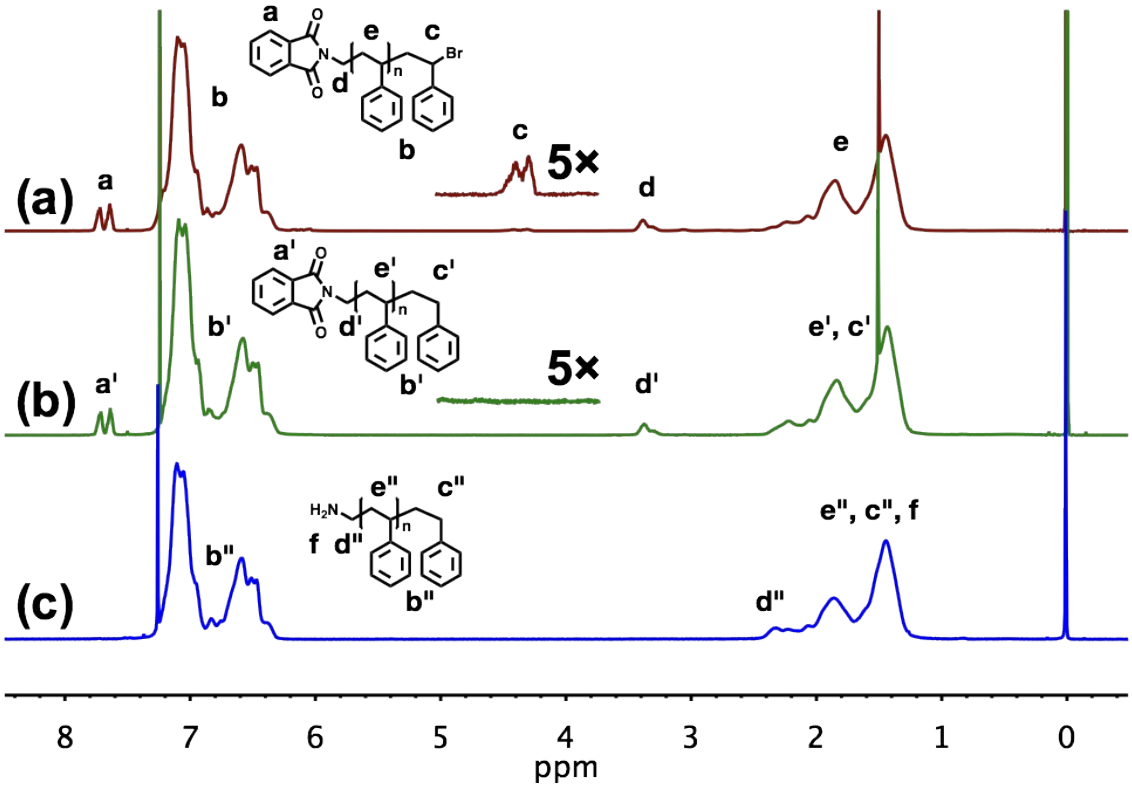

Fig. S2 ^{1}H NMR spectra of (a) PTA-PS-Br, (b) PTA-PS, and (c) PS-NH_2. In spectrum (a), the peaks between 1.15 and 2.40 ppm (group e) are assigned to the aliphatic protons in the PS backbone, the peaks between 6.25 and 7.30 ppm (group b) are assigned to the aromatic protons in the phenyl rings. After reducing (a) PTA-PS-Br to (b) PTA-PS, the peaks c at ~4.35 ppm disappear and the resonance of the resulting terminal protons c' merges with that of the proton group e' in PTA-PS. After reducing (b) PTA-PS to (c) PS-NH_2, peaks a' in phthalimido group disappear. Peak d' shifts upfield to peak d'' due to the formation of primary amine. The signal corresponding to the primary amine (peak f) merges in group e''. Three sharp spikes at 0.00 ppm, 1.56 ppm and 7.26 ppm are assigned to tetramethylsilane, water, and chloroform, respectively.

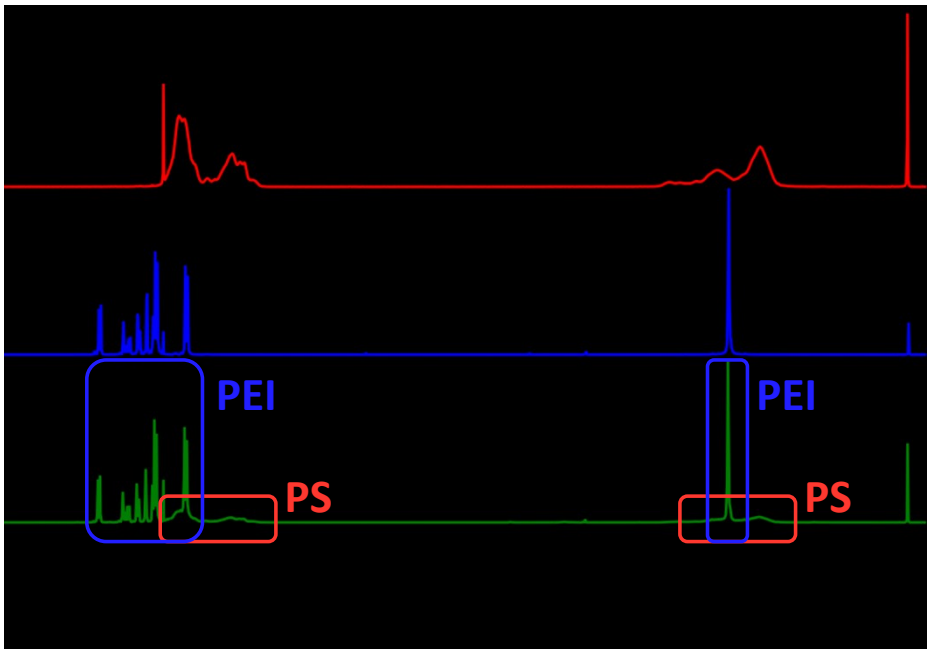

Fig. S3 ^{1}H NMR spectra of (a) PS-NH_2, (b) 8k-PEI-DA, and (c) PS-PEI-PS (SIS-8). The red and blue boxes highlight the peaks from PS and PEI, respectively.

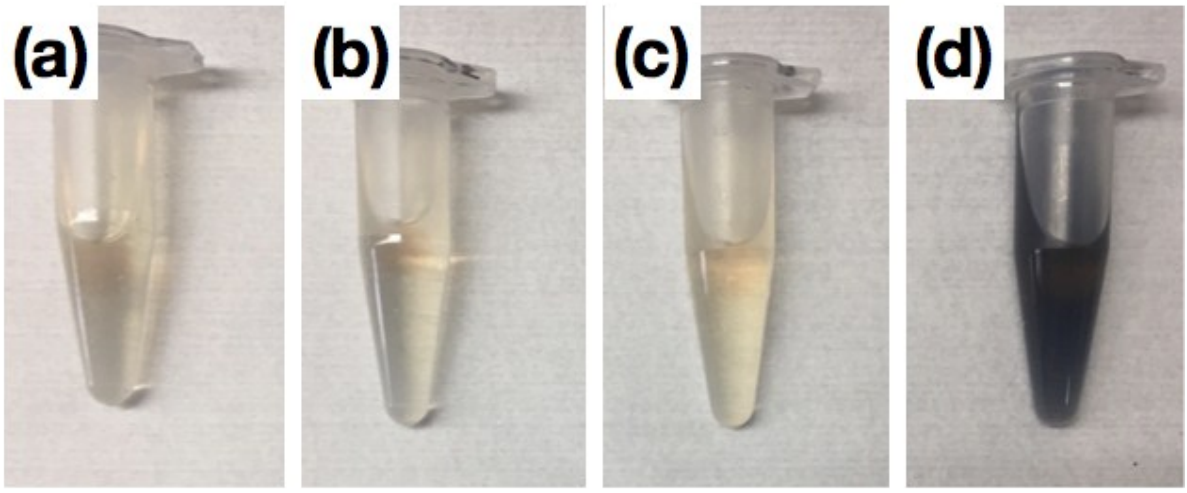

Fig. S4 Ninhydrin test: (a) blank ninhydrin reagent in DCM; (b-d) ninhydrin reagent mixed with a DCM solution of (b) PTA-PS-Br, (c) PTA-PS, and (d) PS-NH_2. The appearance of a dark purple color in (d) confirms the formation of primary amine after the deprotection of phthalimido in PTA-PS.

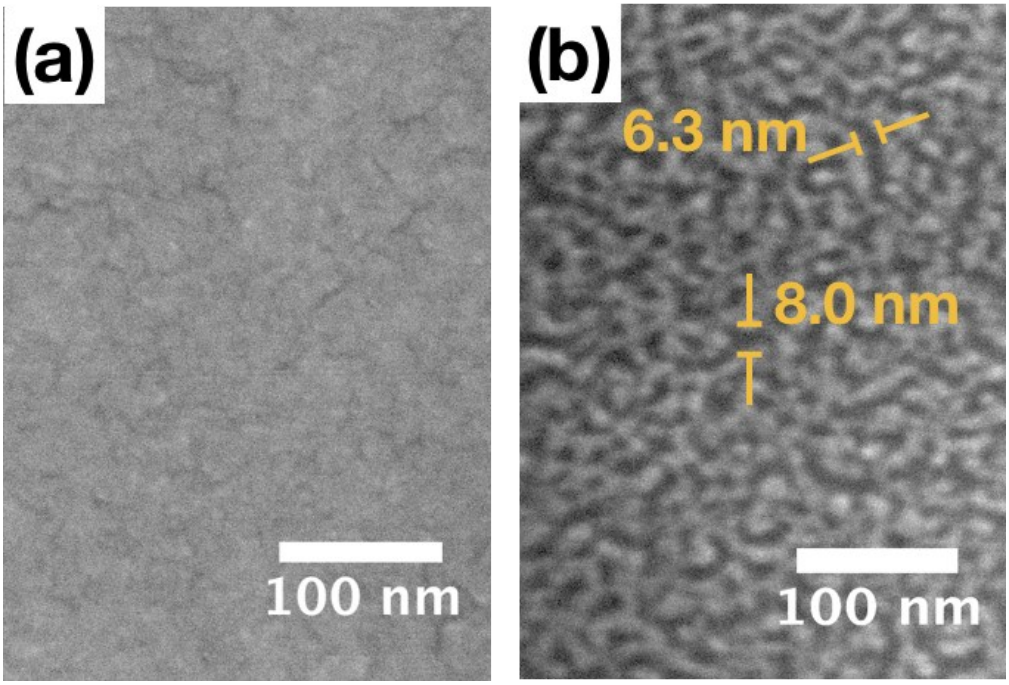

Fig. S5 SEM images of SIS-10 (a) before oxygen plasma etching and (b) after oxygen plasma etching for 1 min.

Table S1 Etching rates of PS and PEI by oxygen plasma.

Sample	Before Etching		After Etching for 1 min		Etching Rate
	Thickness (nm)	Roughness (nm)	Thickness (nm)	Roughness (nm)	(nm/min)
1.5k-PTA-PS-Br	144.0 ± 2.6	12.7 ± 4.6	127.5 ± 4.9	12.9 ± 5.2	16.5 ± 5.5
8k-PEI-DA	49.2 ± 2.4	6.3 ± 1.1	40.7 ± 1.1	4.5 ± 1.7	8.5 ± 2.6
10k-PEI-DA	48.5 ± 2.6	3.1 ± 1.1	43.3 ± 1.8	4.2 ± 0.6	5.2 ± 3.2
12-kPEI-DA	47.8 ± 1.1	4.6 ± 0.9	42.7 ± 0.8	4.1 ± 0.5	5.1 ± 1.4