

Supporting Information for
**Synthesis, Liquid Crystalline Properties, and Lithium
Complexes of Vinyl Polymers with Cyclic Pendants
Containing Ethylene Oxide Units**

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Complexing with triphenylphosphine oxide

Two solutions containing 10 mg of triphenylphosphine oxide dissolved in CHCl_3 were marked as A and B. Then 10 mg of PEOT-6 was put into B, and both solutions were stirred at ambient temperature for 48 h. After filtration to remove PEOT-6, ultraviolet-visible spectra of both solutions were detected. The absorbency of B reduced 30 percent compared to that of A, which meant that 3 mg of triphenylphosphine oxide was adsorbed by 10 mg of PEOT-6.

Thermal stability of the complexes

The thermal stability decreases both for PEOT-4 and PEOT-5 complexes, and it has no quantitative relationship with respect to the amount of introduced lithium salts in the case of LiBFS (Tables S2 and S3). EO complexes with lithium, which can weaken the carbon-oxygen bond in side groups and make the polymer decompose at lower temperatures. Essentially, the more salt introduced, the lower the decomposition temperature of the polymer. However, the weight loss originates from all compositions in the complex, and the $T_{5\%}$ of LiBFS is 355 °C, with little LiBFS decomposing near the decomposition temperature of the polymer. The molecular weight of LiBFS is relatively large (287), which means that

the majority of the salt is not decomposed in this temperature range. Because of these two opposite trends, the decomposition temperature of the complex changes irregularly with respect to the quantity of introduced lithium salts. The molecular weight of lithium chloride is much smaller (42), and PEOT-n is the majority of the complex. Therefore, the temperature of 5% weight loss of the complex from LiCl and PEOT-n decreases monotonously with more dissolved lithium chloride. Thermal stability of PEO homopolymers decrease when introducing lithium salts because lithium weakens the carbon-oxygen bond of Eos.

Table S1 Copolymerization results of EOT-6 and styrene via conventional radical polymerization

Polymer ^a	[EOT-6]:[St]	$M_{n,GPC}^b$ (10 ³ g/mol)	PDI_{GPC}^b	$M_{n,GPC-LS}^c$ (10 ³ g/mol)	PDI_{GPC-LS}^c
CPES-1	2:98	6.6	1.8	34.1	1.6
CPES-2	5:95	7.2	2.1	37.9	1.8
CPES-3	10:90	7.6	2.0	42.1	1.8
CPES-4	20:80	8.1	2.3	47.9	1.9

^a Polymerization condition: solvent, chlorobenzene; concentration, 15(wt%); temperature, 60 ± 0.5 °C; [initiator]:[monomer] = 1:75; ^b Number-average molecular weight ($M_{n,GPC}$), weight-average molecular weight ($M_{w,GPC}$), and polydispersity index ($PDI_{GPC} = M_{w,GPC}/M_{n,GPC}$) were obtained by gel permeation chromatography calibrated against polystyrene standards; ^c Number-average molecular weight ($M_{n,GPC-LS}$), weight-average molecular weight ($M_{w,GPC-LS}$), and polydispersity index ($PDI_{GPC-LS} = M_{w,GPC-LS}/M_{n,GPC-LS}$) were estimated with a GPC-LS online technique.

Table S2 Thermal properties of complexes of PEOT-4 and lithium salts

Run	EO/Li^a	T_g^b (°C)	T_{5%}^c (°C)
PEOT-4	-	131	370
PEOT-4-LiBFS-1	50/1	129	345
PEOT-4-LiBFS-2	20/1	121	314
PEOT-4-LiBFS-3	10/1	110	287
PEOT-4-LiBFS-4	8/1	106	300
PEOT-4-LiBFS-5	6/1	89	315
PEOT-4-LiBFS-6	4/1	76	314
PEOT-4-LiBFS-7	2/1	51	314
PEOT-4-LiCl-1	6/1	131	334
PEOT-4-LiCl-2	2/1	132	312

^a The molar ratio of EO to lithium in the complexes; ^b Glass transition temperature was estimated by differential scanning calorimetry during the second heating process under a nitrogen atmosphere; ^c Temperature at which the weight loss of the complex reached 5% under a nitrogen atmosphere.

Table S3 Thermal properties of complexes of PEOT-5 and lithium salts

Run	O/Li^a	T_g^b (°C)	T_{5%}^c (°C)
PEOT-5	-	141	335
PEOT-5-LiBFS-1	10/1	107	308
PEOT-5-LiBFS-2	8/1	101	293
PEOT-5-LiBFS-3	6/1	91	292
PEOT-5-LiBFS-4	4/1	86	295
PEOT-5-LiBFS-5	2/1	52	311
PEOT-5-LiCl-1	6/1	143	327
PEOT-5-LiCl-2	2/1	147	312

^a The molar ratio of EO to lithium in the complexes; ^b Glass transition temperature was estimated by differential scanning calorimetry during the second heating process under a nitrogen atmosphere; ^c Temperature at which the weight loss of the complex reached 5% under a nitrogen atmosphere.

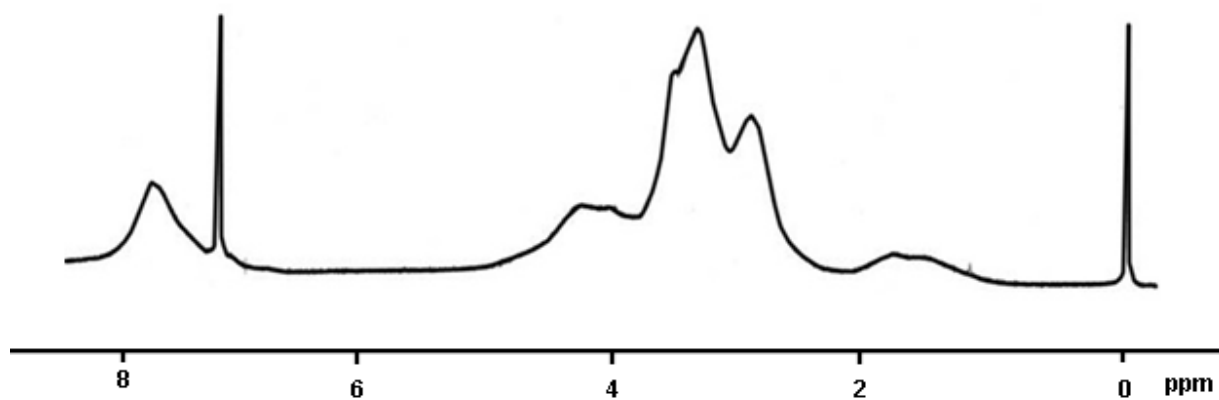
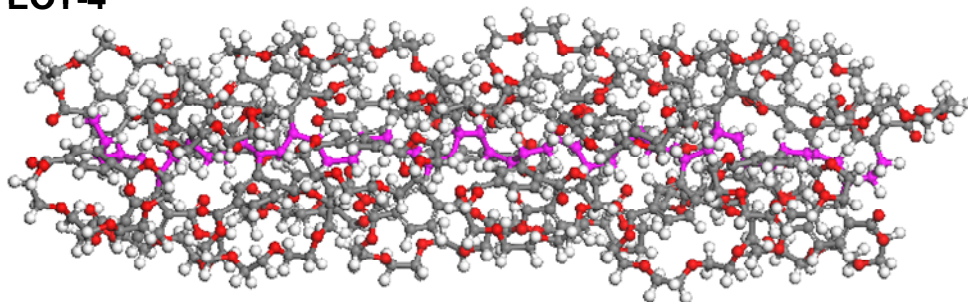


Fig. S1 ^1H NMR spectrum of PEOT-4 in CDCl_3 .

PEOT-4



PEOT-5

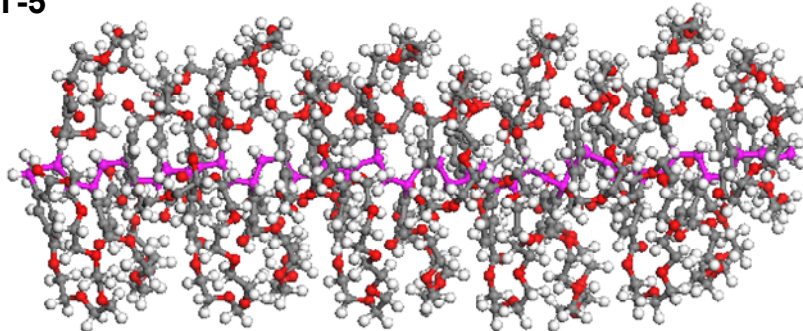
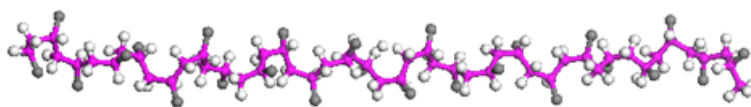


Fig. S2 Molecular structures of PEOT-4 and PEOT-5 simulated by Materials Studio 5.0 (Accelrys).

PEOT-4



PEOT-5

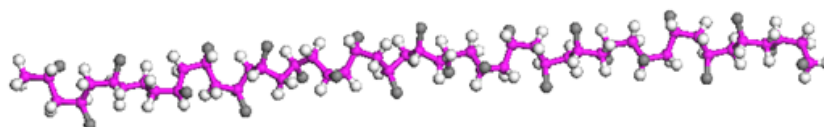


Fig. S3 Molecular backbone structures of PEOT-4 and PEOT-5 simulated by Materials Studio 5.0 (Accelrys).

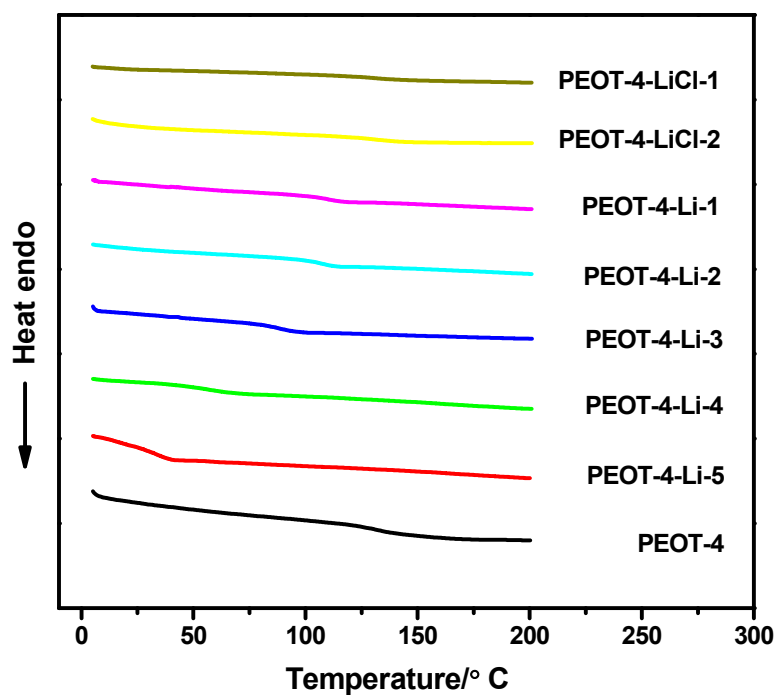


Fig. S4 Differential scanning calorimetric thermograms of PEOT-4 and its complexes with lithium salts.

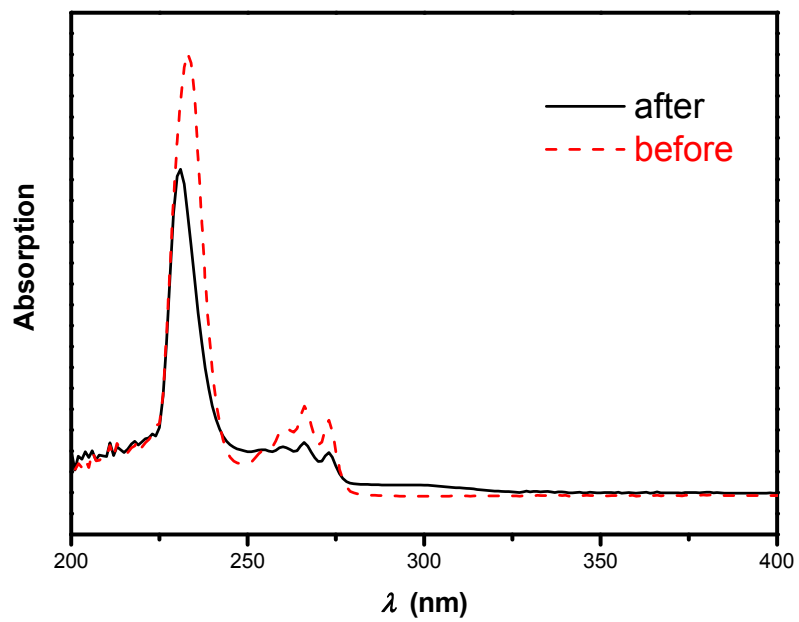


Fig. S5 Ultraviolet-visible spectra of triphenylphosphine oxide before and after adsorption of PEOT-6.