Supporting Information

Synthesis and LCST-Type Phase Behavior of Water-Soluble Polypeptide with Y-Shaped and Charged Side-Chains

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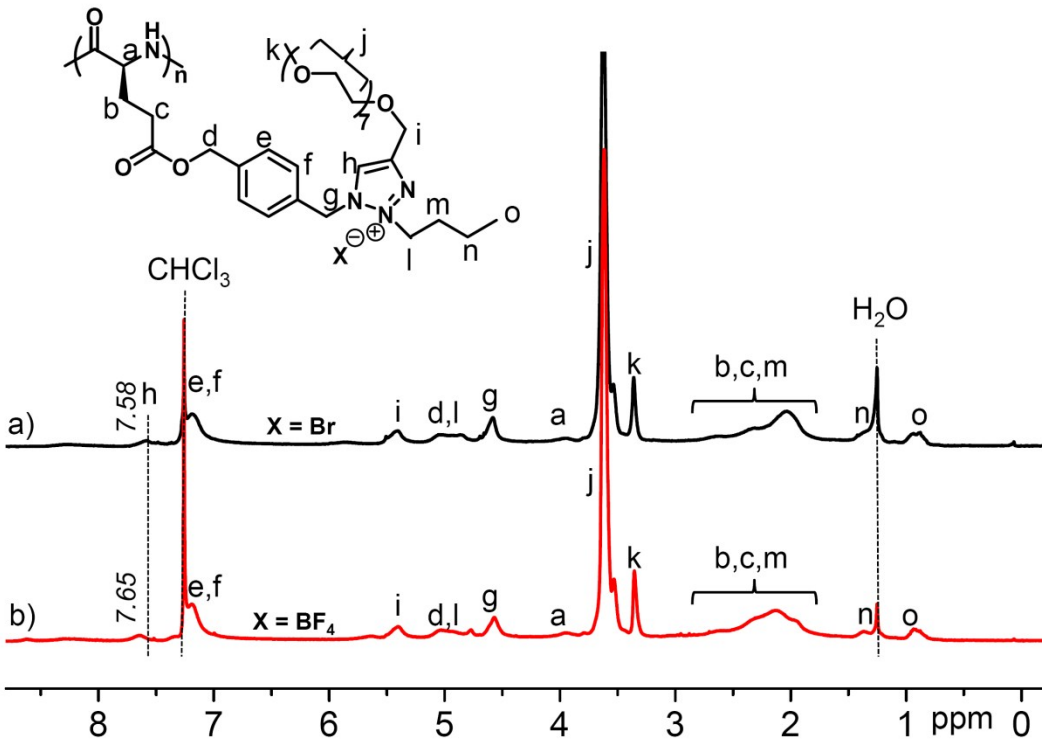

Figure S1. ^{1}H NMR spectra of PMBLG-OEG$_7$/C$_4$-X (X = Br or BF$_4$) in CDCl$_3$.

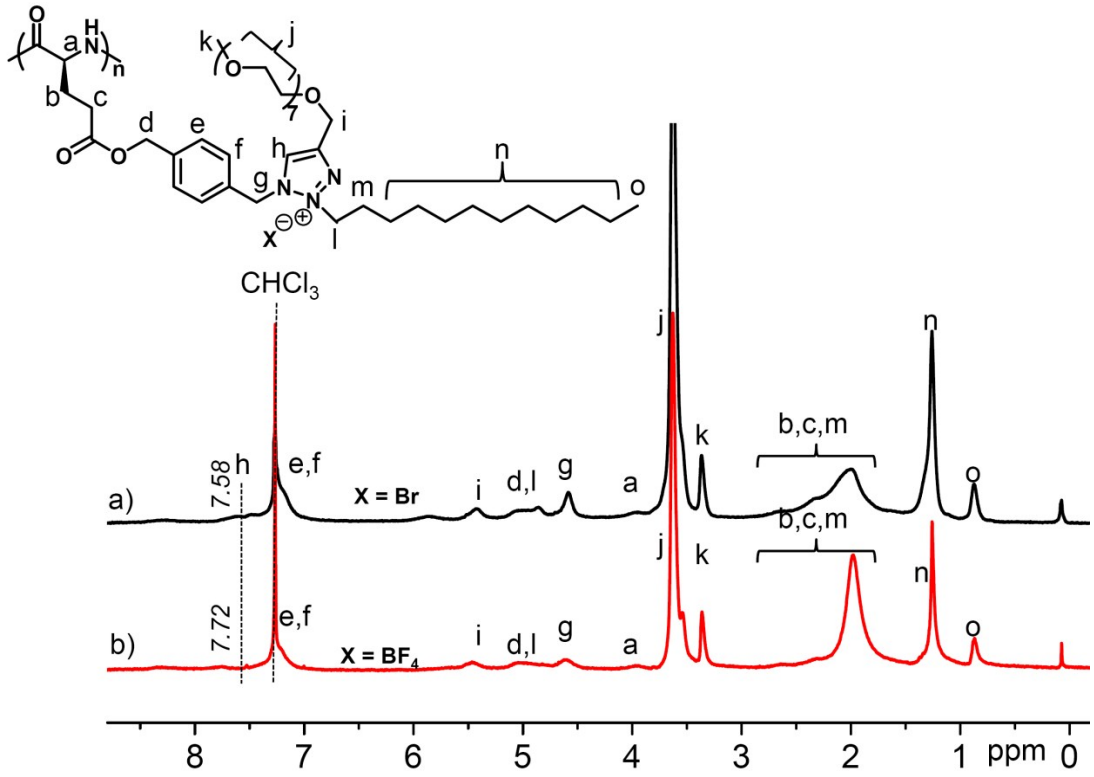

Figure S2. ^{1}H NMR spectra of PMBLG-OEG$_7$/C$_{12}$-X (X = Br or BF$_4$) in CDCl$_3$.

Table S1. Elemental analysis results of PMBLG-OEG_7/C_m-BF_4 samples.

Samples	C (%)		H (%)		N (%)		O (%)	
	Calcd	Found	Calcd	Found	Calcd	Found	Calcd	Found
PMBLG-OEG_7/C_4-BF_4	52.77	52.53	7.21	7.25	7.03	7.07	22.09	22.33
PMBLG-OEG_7/C_6-BF_4	53.89	53.69	7.46	7.49	6.79	6.83	21.34	21.75
PMBLG-OEG_7/C_{12}-BF_4	56.82	57.60	8.10	8.14	6.16	6.18	19.36	19.67

Table S2. Solubility characteristics of PMBLG-OEG_7 and PMBLG-OEG_7/C_m-X samples in various solvents.

Solvents	PMBLG -OEG_7	PMBLG-OEG_7/C_m-Br			PMBLG-OEG_7/C_m-BF_4		
		m = 4	m = 6	m = 12	m = 4	m = 6	m = 12
DMSO	S	S	S	S	S	S	S
DMF	S	S	S	S	S	S	S
H_2O	L	S	S	S	L	L	L
MeOH	S	S	S	S	S	S	S
EtOH	S	S	S	S	S	S	S
THF	S	I	I	I	I	I	I
EAc	I	I	I	I	I	I	I
DEE	I	I	I	I	I	I	I
TCM	S	S	S	S	S	S	S
DCM	S	S	S	S	S	S	S
Hexane	I	I	I	I	I	I	I

DMSO = dimethyl sulphoxide; DMF = *N*,*N*-dimethylformamide; MeOH = methanol; EtOH = ethanol; THF = tetrahydrofuran; EAc = ethyl acetate; DEE = diethyl ether; TCM = trichloromethane; DCM = dichloromethane; S = soluble; I = insoluble; L = LCST-type phase transition (concentration = 10 $mg \cdot mL^{-1}$).

Table S3. Mean residual ellipticity ($[\theta]_{222}$) and fractional helictiy (f_H) of PMBLG-OEG_7 and PMBLG-OEG_7/C_m-X samples in DI-H_2O (0.05 $mg \cdot mL^{-1}$).

Name	$[\theta]_{222}$	f_H (%)
PMBLG-OEG_7	-32,411	91
PMBLG-OEG_7/C_4-Br	-20,800	61
PMBLG-OEG_7/C_6-Br	-16,981	51
PMBLG-OEG_7/C_{12}-Br	-14,018	44
PMBLG-OEG_7/C_4-BF_4	-23,177	67
PMBLG-OEG_7/C_6-BF_4	-18,005	54
PMBLG-OEG_7/C_{12}-BF_4	-14,987	46

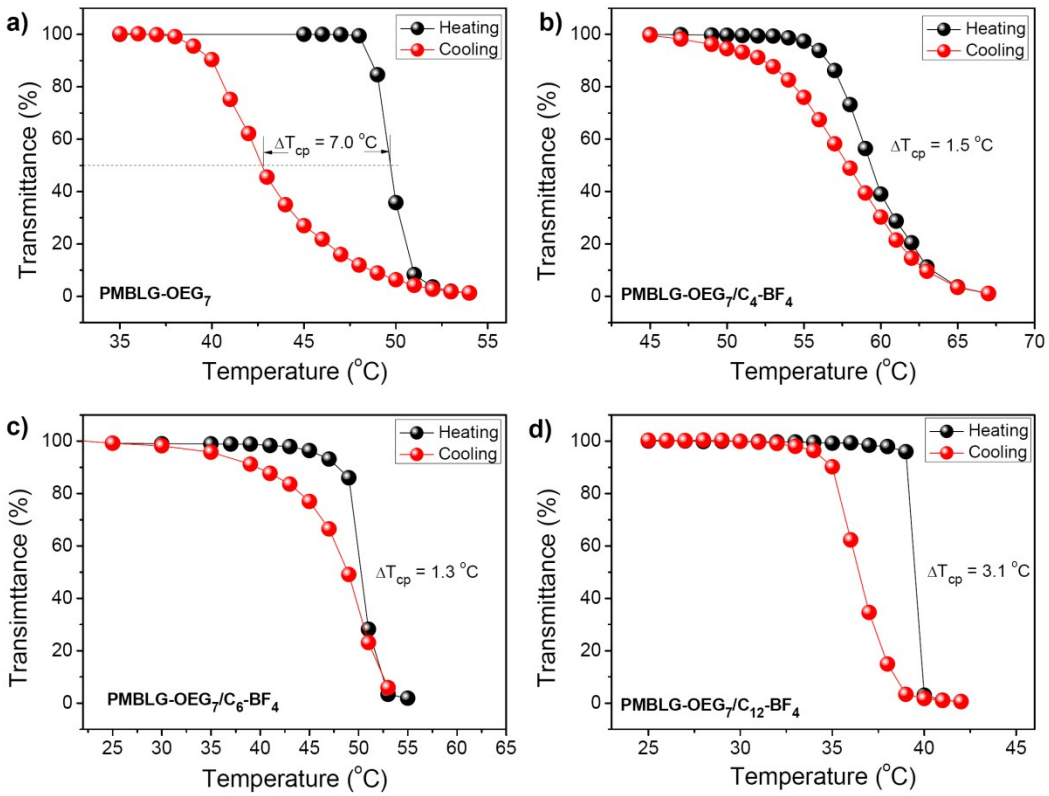

Figure S3. The plots of transmittance at λ = 500 nm versus temperature for the aqueous solutions of (a) PMBLG-OEG_7 and (b-d) PMBLG-OEG_7/C_m-BF_4 (m = 4, 6, and 12) in DI-H_2O (polymer concentration = 10 mg·mL^{-1}).

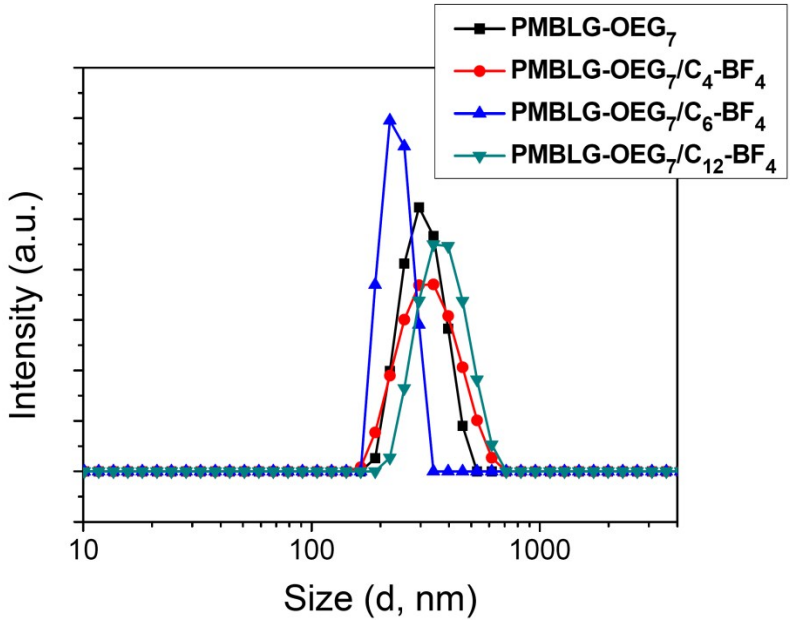

Figure S4. DLS size distribution plots of PMBLG-OEG_7 and PMBLG-OEG_7/C_m-BF_4 (m = 4, 6, and 12) at the temperatures above respective T_{cp}s. (polymer concentration = 1 mg·mL^{-1})

Table S4. DLS results of resulting polypeptides in DI-H_2O above respective T_{cp} (polymer concentration = 1 mg·mL^{-1}).

Name	Diameter (nm)	PDI [a]
PMBLG-OEG_7	331.7	0.183
PMBLG-OEG_7/C_4-BF_4	290.3	0.378
PMBLG-OEG_7/C_6-BF_4	221.3	0.109
PMBLG-OEG_7/C_{12}-BF_4	349.6	0.201

[a] Distribution of polymer aggregates in the solvents.

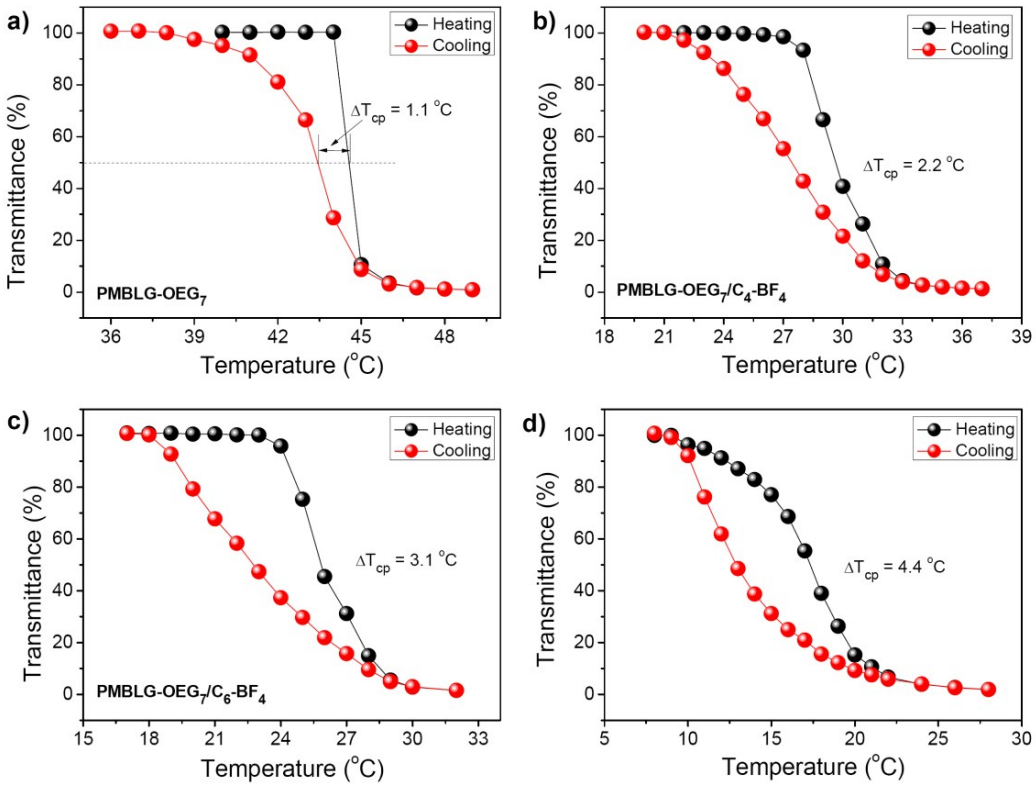

Figure S5. The plots of transmittance at λ = 500 nm versus temperature for the $NaBF_4$ aqueous solutions (salt concentration = 5 mg·mL^{-1}) of (a) PMBLG-OEG_7 and (b-d) PMBLG-OEG_7/C_m-BF_4 (m = 4, 6, and 12) (polymer concentration = 5 mg·mL^{-1}).

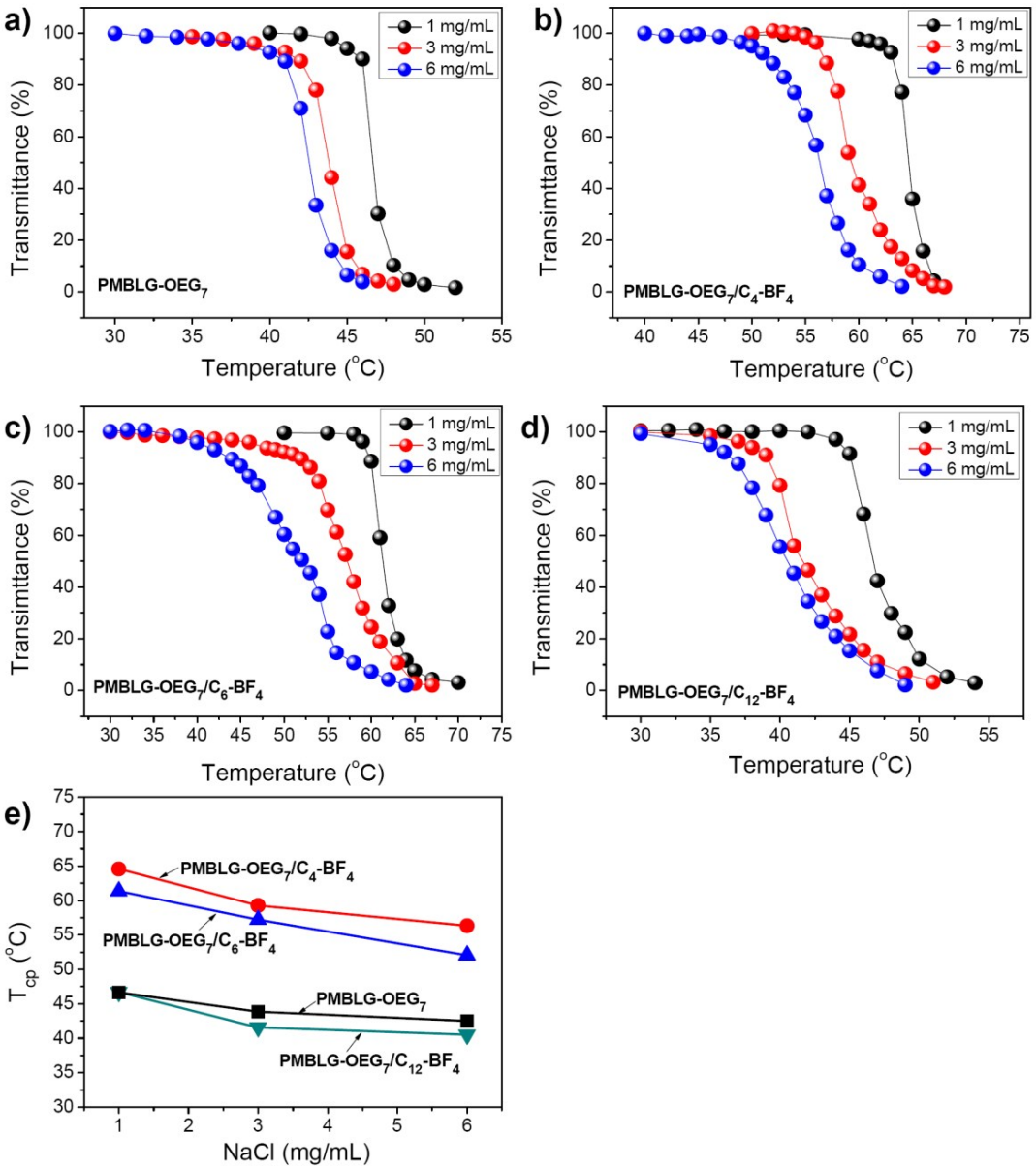

Figure S6. The plots of transmittance at λ = 500 nm versus temperature for the NaCl aqueous solutions of (a) PMBLG-OEG$_7$ and (b-d) PMBLG-OEG$_7$/C$_m$-BF$_4$ (m = 4, 6, and 12) (salt concentration = 1, 3, 6 mg·mL^{-1}). (e) The plots of T_{cp} versus concentrations in $NaBF_4$ aqueous solution (polymer concentration = 5 mg·mL^{-1}).

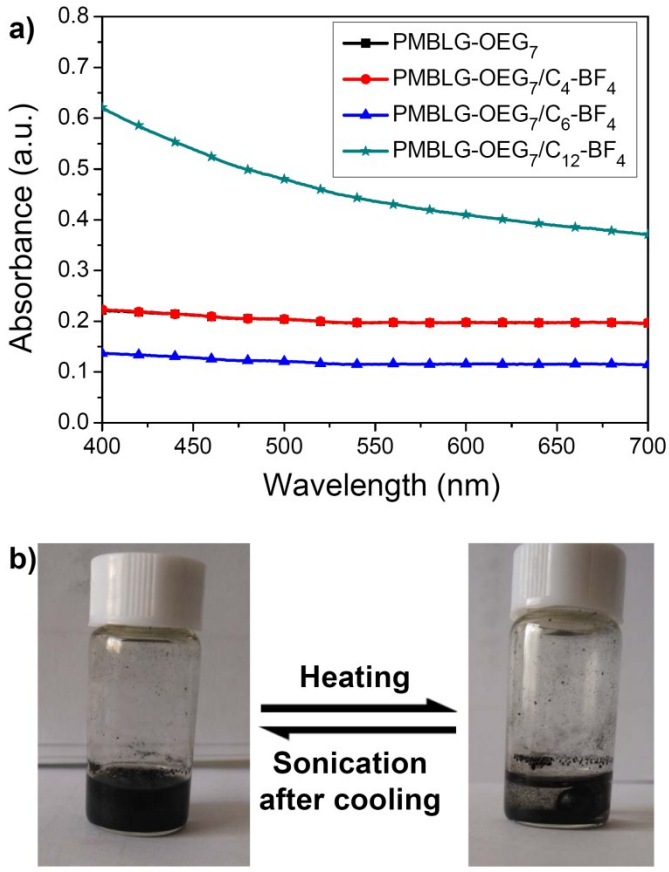

Figure S7. (a) UV-vis spectra of polymer/SWCNT/NaCl aqueous solutions (polymers: PMBLG-OEG_7 and PMBLG-OEG_7/C_m-BF_4, salt concentration = 6 mg·mL^{-1}, the solutions were diluted 10 times before UV-vis measurement). (b) Optical images of PMBLG-OEG_7/C_{12}-BF_4/SWCNT/NaCl aqueous solution at room temperature (left) and temperature above the T_{cp} (right).

Table S5. SWCNT dispersibility in NaCl aqueous solution (salt concentration = 6 mgm·L^{-1}) in the presence of PMBLG-OEG_7 and PMBLG-OEG_7/C_m-BF_4 (m = 4, 6, and 12).

Samples	PMBLG-OEG_7		PMBLG-OEG_7/C_4-BF_4		PMBLG-OEG_7/C_6-BF_4		PMBLG-OEG_7/C_{12}-BF_4	
	DI-H_2O	$NaCl_{aq}$	DI-H_2O	$NaCl_{aq}$	DI-H_2O	$NaCl_{aq}$	DI-H_2O	$NaCl_{aq}$
$[A]_{500}$[a]	0.045	0.204	0.003	0.205	0.003	0.121	0.003	0.480
Dispersibility[b] (mg·L^{-1})	32.6	147.8	2.2	148.6	2.2	87.7	2.2	347.8

[a]The absorbance at 500 nm which was determined by UV-vis spectroscopy. Polymer aqueous solutions were diluted 10 times before UV-vis measurement.

[b]Dispersibility = $10 \times [A]_{500}/0.0138$.[1]

1. Q. Hu, Y. Deng, Q. Yuan, Y. Ling and H. Tang, *J. Polym. Sci. Part A: Polym. Chem.*, 2014, **52**, 149-

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