Supporting Information

1. Characterization of hydrophobically modified polymer

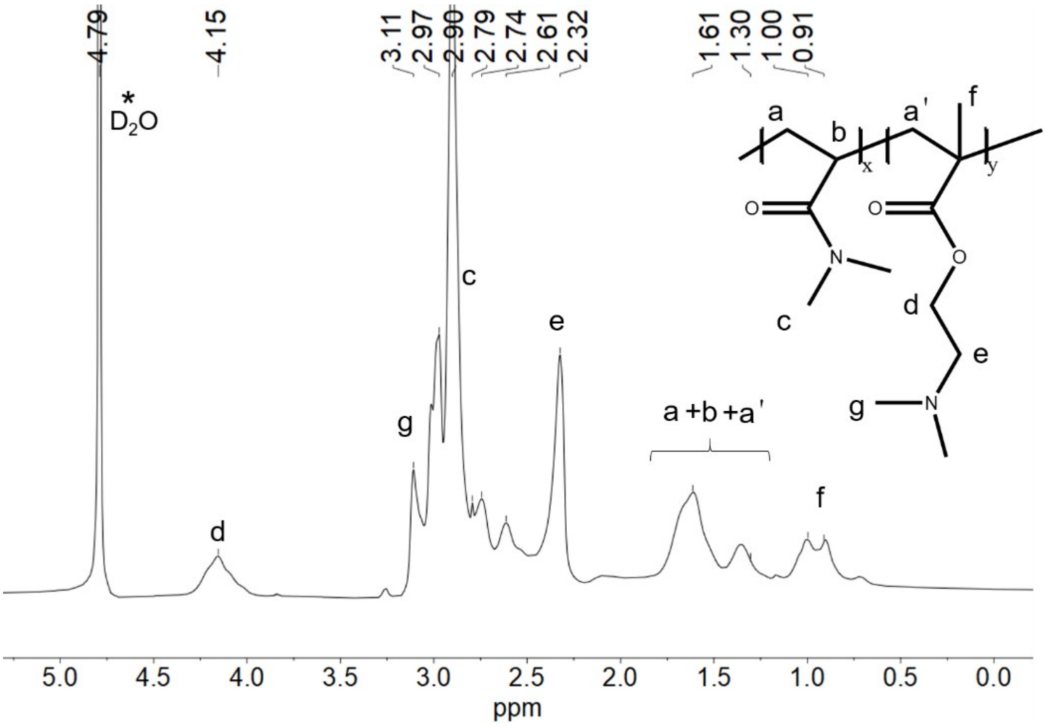

Figure S1. ^{1}H NMR spectrum of copolymer precursor, D_2O, $T = 298$ K.

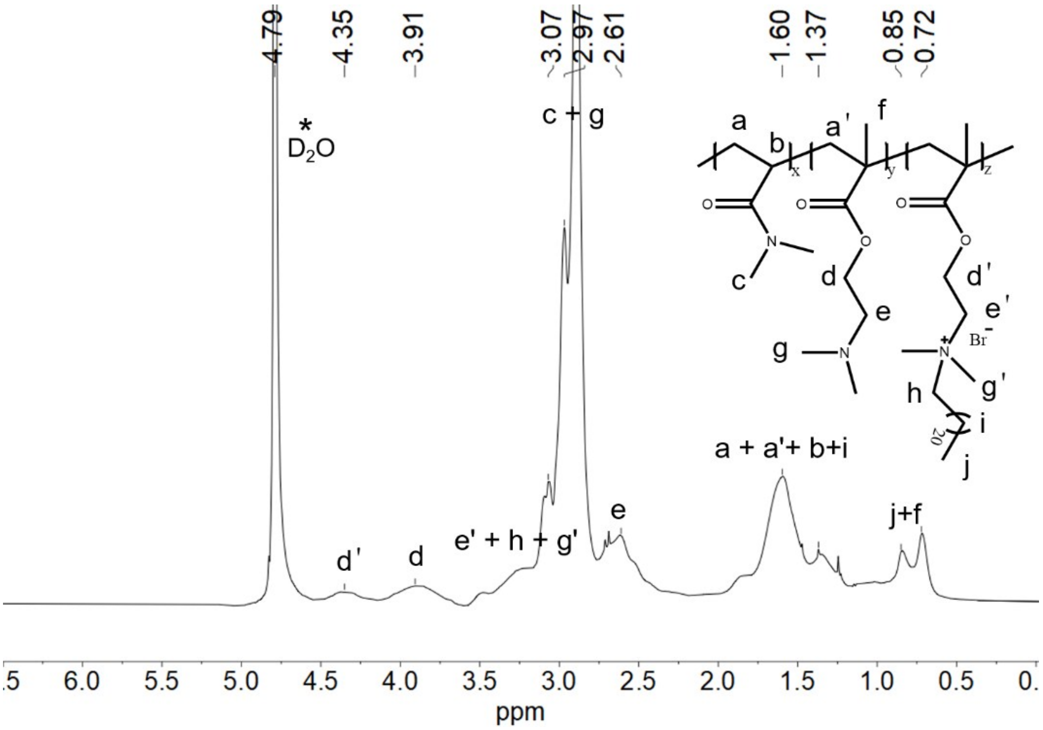

Figure S2. ^{1}H NMR spectrum of hydrophobically modified polymer, D_2O, $T = 298$ K.

Table S1. Characteristics of the precursors and the hydrophobic modified polymers

Polymer[a]	M_w (kg/mol)	Br/C	
		Titration of Br^-	Elemental analysis[c]
$A_{80}M_{16}C_4$	1100	0.043	0.042
	640	0.047	0.040
	380	0.045	0.042
$A_{76}M_{20}C_4$	1450	0.045	0.041
$A_{64}M_{30}C_4$	1600	0.045	0.041
$A_{56}M_{40}C_4$	1500	0.044	0.045
$A_{96}M_0C_4$	1400	0.049	0.043
$A_{80}M_{19}C_1$	1700	0.011	0.009
$A_{80}M_{16}C_4$ (C_{18} modified)[b]	1300	0.041	0.048
$A_{80}M_{16}C_4$ (C_{14} modified)[b]	1300	0.048	0.046
$A_{65}M_{20}C_{15}$ (C_{10} modified)[b]	1250	0.141	0.157

a. The hydrophobicity was regarded as same for some polymer modified with C_{22}, C_{18} and C_{14} chins by titration where the disparity of hydrophobic degree was less than 0.5 mol%

b. "C_{18} modified", "C_{14} modified" and "C_{10} modified" was referred to as the polymer that grafted with 1-bromooctadecane, 1-bromotetradecane and 1-bromodecane, respectively.

c. The experimental procedure is followed by the previous literature[1] and given below. The completely dried test samples (W_1, mg) were combusted by the Schoniger oxygen flask combustion method. The combusted products were washed into a flask with 10 mL of deionized water. To this solution, bromophenol blue (0.1 mL, 0.1% in ethanol) was added. Nitric acid solution was added dropwise until the sample solution became yellow, and an excess of nitric acid (0.5 mL) was then added. Afterward, the diphenyl carbazone indicator (50 mL, 0.1% in ethanol) was added. Titration was carried out using 0.05 M Hg(II) nitrate (in water), to a purple end point (V_1). A blank determination was also carried out, and the value subtracted from the sample titration (V_2). The Hg(II) nitrate solution was standardized against a known amount of sodium chloride (W_2, mg) as sodium chloride aqueous solution (250 mL). A small amount of this solution (10 mL) was taken for titration to give the factor, as defined in eq (2).

$$\%Br = \frac{V_1 - V_2}{W_1} \times \frac{80}{35.5} \times \alpha \times 100 \qquad (1)$$

The α in eq (1) was calculated using eq (2).

$$\alpha = \frac{10 \times W_2}{250} \times \frac{0.6068}{V_1} \qquad (2)$$

2. Critical overlap concentration C* determined by rheology (A_{80}-M_{16}-C_4 for example)

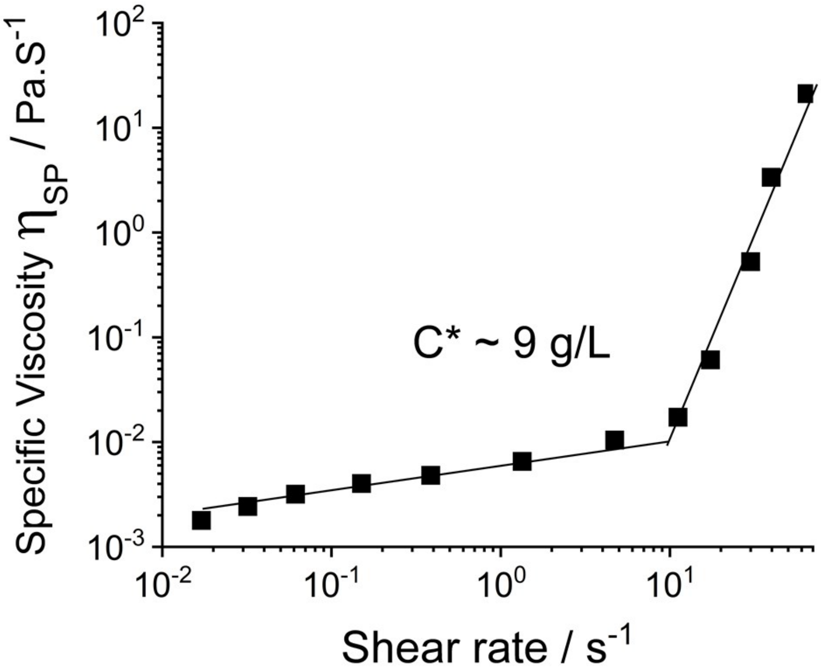

Figure S3. Concentration dependence of the specific viscosity for A_{80}-M_{16}-C_4 at room temperature. The viscosity at the shear plateau was used to estimate the specific viscosity η_{sp}.

3. pH titration study

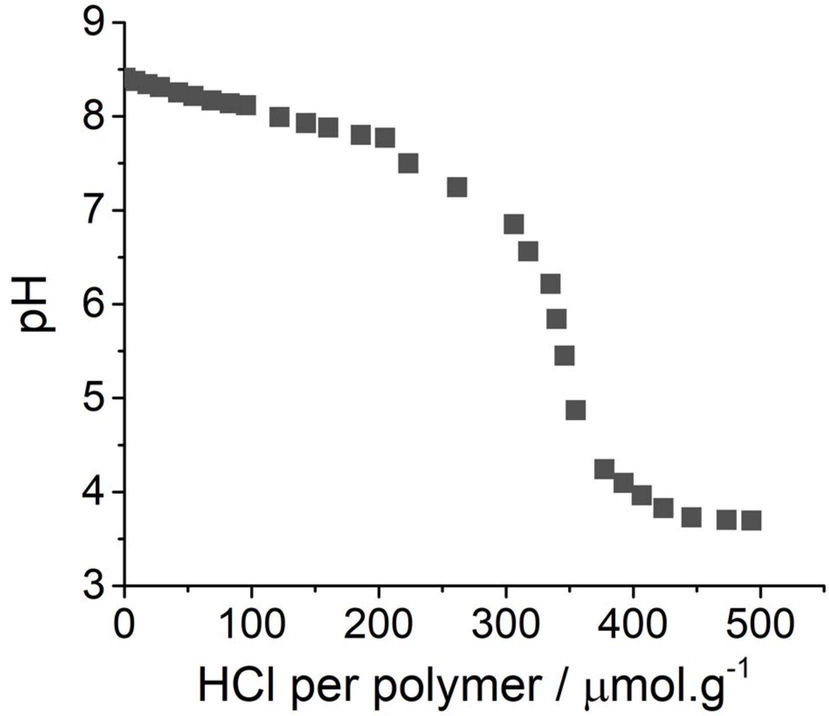

Figure S4. pH titration of aqueous solution of associative amphiphilic polymer (5 g L^{-1}) against HCl at 298 K.

4. Stress-ramp experiment results

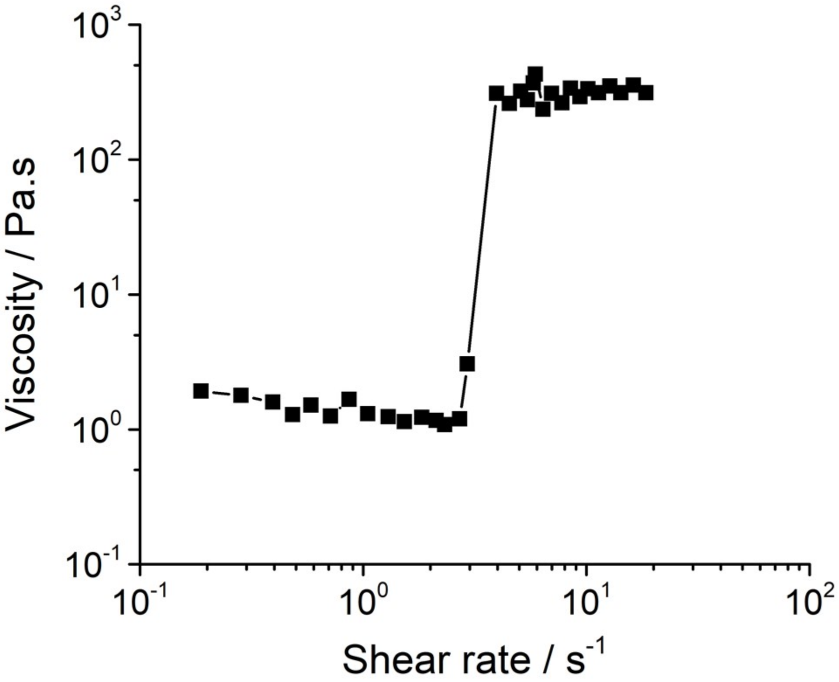

Figure S5. Stress-ramp experiment on the sample of 35 g L^{-1} $A_{80}M_{16}C_4$ solution. At low stress, the sample showed a Newtonian response similar to strain-controlled experiments. Abnormal shear-thickening was observed for this sample when δ_{crit} was beyond 3.5 Pa.

5. DLS study

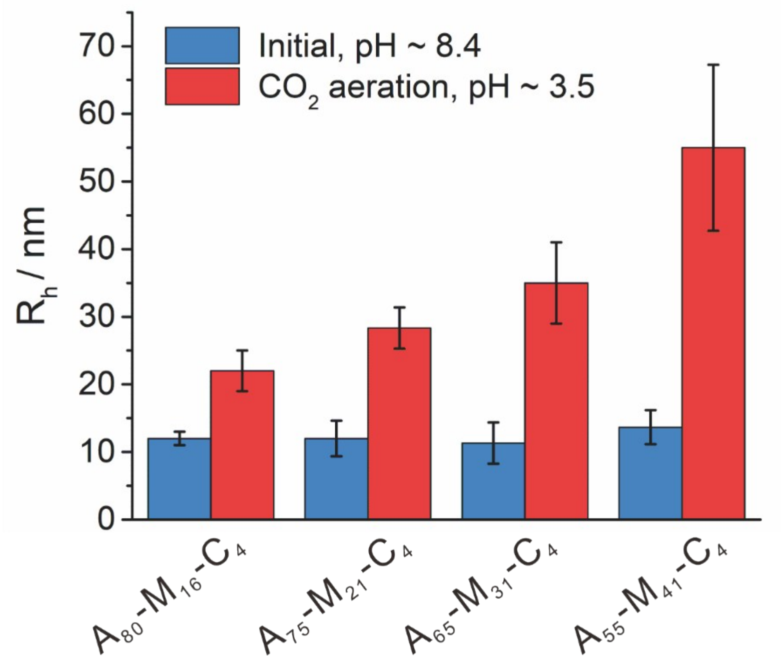

Figure S6. DLS results of the sample of 0.1 g L^{-1} polymer solution with different charge density. T = 293 K.

References

1. a) A. M. Ramadan, S. Mosleh, S. M. Gawish, *J. Appl. Polym. Sci.* **2001**, 81, 2318–2323.

   b) D. Roy, J. S. Knapp, J. T. Guthrie, S. Perrier, *Biomacromolecules*. **2008**, 9, 91–99.