Supporting Information

Sensing Carbon Dioxide through Solution Transparency

Change of Gas-Responsive Polymers

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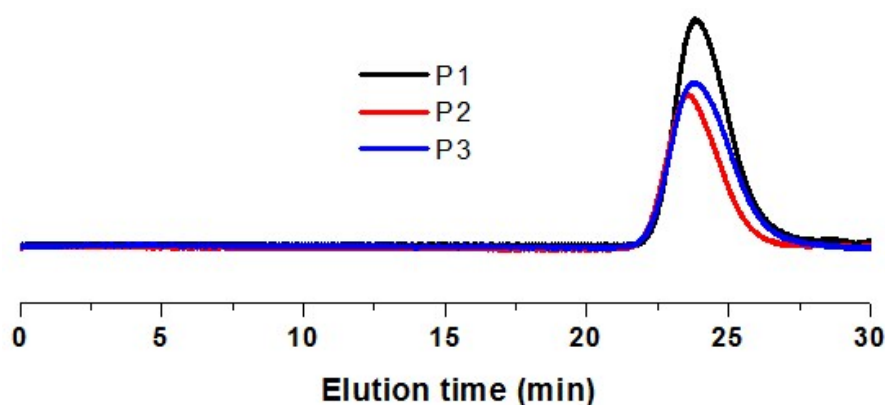
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Figure S1. Size exclusion chromatograph (SEC) traces of the various polymers (P1-P3) dissolved in DMSO. All the polymers show a unimodal distribution. The SEC results revealed only the relative molecular weights and polydispersity indices among all the samples. The data of the apparent Mn in Table 1, obtained with poly(methyl methacrylate) (PMMA) standard samples, are systematically higher than what they should be assuming complete monomer conversions. The measurement of molecular weight of such UCST polymers using SEC was found to be problematic.[1] It appears that PMMA was not an appropriate standard for those polymers in DMSO, probably because they do not have the same interactions with the used SEC columns. This difficulty may also account for the apparent large polydispersities of the samples (Table 1). Nevertheless, it should be emphasized that this drawback in the molecular weight determination does not affect in any way the main findings, conclusions and interest of the present study.
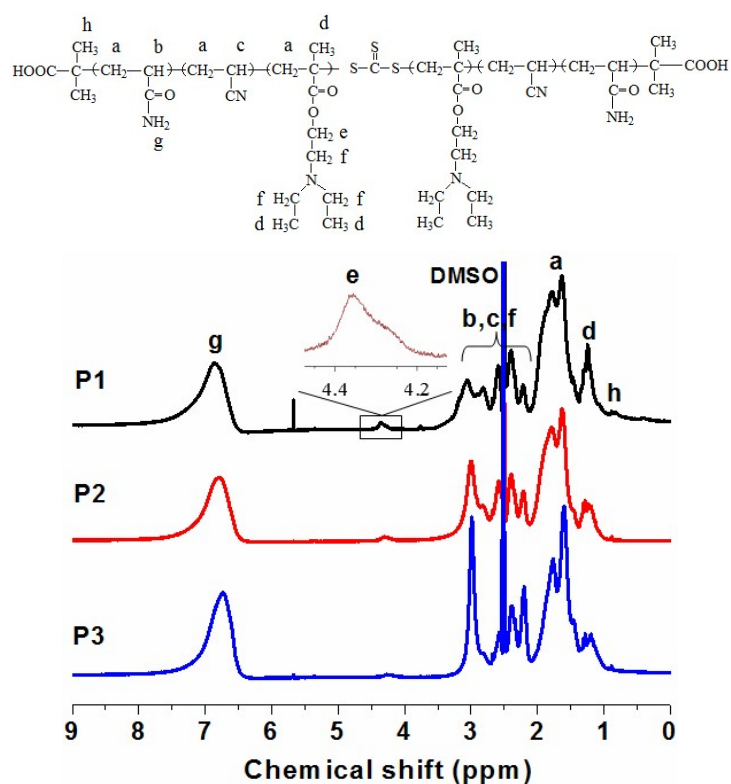
Figure S2. ^{1}H NMR spectra of the UCST random copolymers (P1-P3) synthesized using RAFT polymerization.
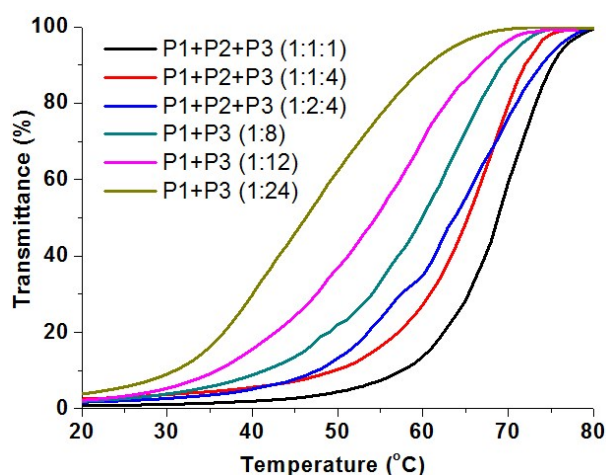

Figure S3. Transmittance change vs. temperature on cooling for mixed P(AAm-*co*-AN-*co*-DEAEMA) solutions with different fractions of mass of P1, P2 and P3 (weight ratio in parentheses, total polymer concentration: 5.0 mg/mL). The effect of mixing two or three of the copolymer samples in aqueous solution on the UCST phase transition was investigated. Figure S3 shows the plots of transmittance vs. temperature for various solution with different fractions of mass of P1, P2 and P3. With increasing the amount of P2, especially P3, the transmittance change in the UCST region becomes gradual.
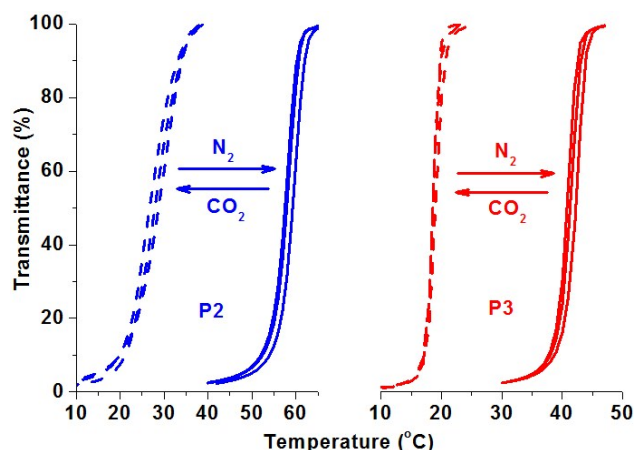
Figure S4. Reversible transmittance changes vs. temperature on cooling for P2 and P3 solutions upon three cycles of alternating CO_2 and N_2 bubbling, solutions being purged with either CO_2 for 5 min (dashed lines) or N_2 for 15 min (solid lines).
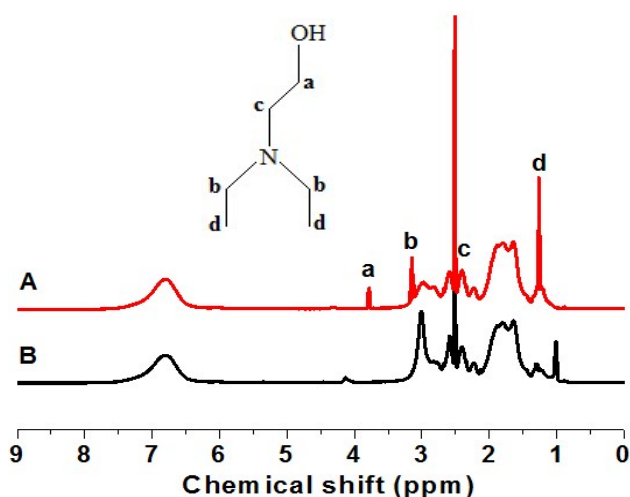

Figure S5. ^1H NMR spectra of P1 recorded in d6-DMSO at 100 °C with its aqueous solution subjected to four cycles of transmittance vs. temperature measurements (from 80 °C to 20 °C, 1.0 °C/min) after being treated with a) alternating addition of HCl/NaOH for pH change and b) alternating bubbling of CO_2/N_2 (polymer recovered by lyophilization). While the spectrum remains essentially unchanged after gas treatment, new resonance peak and peak shifts appear in the spectrum with successive additions of HCl/NaOH, which indicates the hydrolysis of DEAEMA units and formation of N,N-diethylethanolamine under the used experimental conditions.[2,3]

REFERENCES

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3. F. Liu, J. Seuring, S. Agarwal, *J. Polym. Sci., Part A: Polym. Chem.,* 2012, **50**, 4920-4928.