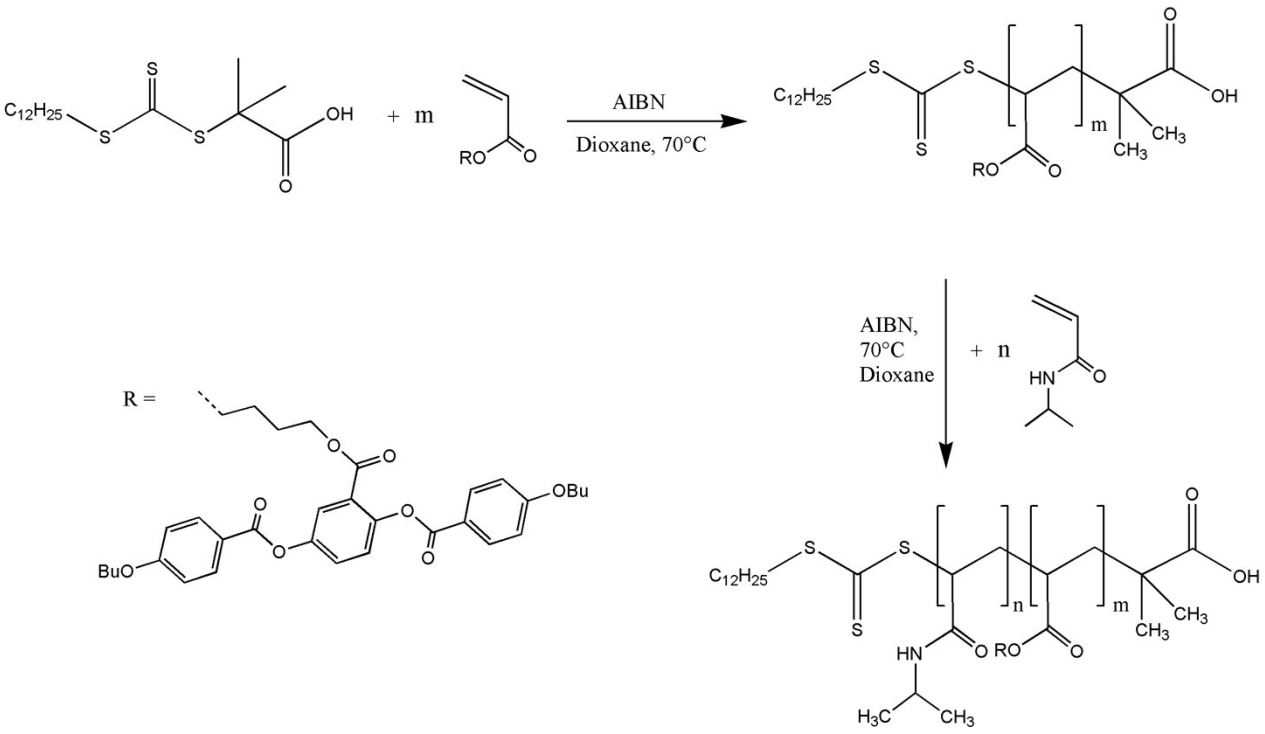
Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information

Actuating Thermo- and Photo-responsive Tubes from Liquid Crystalline Elastomers

Lukas B. Braun, Tristan Hessberger, Eva Pütz, Carsten Müller, Frank Giesselmann, Christophe A. Serra, Rudolf Zentel*

Synthesis of the surfactant copolymer p(LC)-block-p(NIPAAm)



Experimental procedure:

Poly(LC): 300 mg (0.47 mmol) of the LC-monomer (4-acryloyloxybutyl)-2,5-di-(4-butyloxybenzoyloxy) benzoate, 3.4 mg (0.0094 mmol) of CTA 2-(dodecylthiocarbonothioylthio)-2-methylpropionic acid and 0.2 mg (0.0012 mmol) of the initiator AIBN were dissolved in 1 mL of dioxane. The reaction mixture was degassed by three freeze-pump-thaw cycles and the polymerization was carried out in a Schlenk tube under argon atmosphere at 70 °C for 3 days. The resulting polymer poly(LC) (130 mg, 43%) was precipitated for three times in cold methanol and dried in vacuo.

^{1}H NMR (400 MHz, CDCl3, δ): 8.08 (br, 4H; Ar H), 7.81 (br, 1H; Ar H), 7.39 (br, 1H; Ar H), 7.16 (br, 1H; Ar H), 6.89 (br, 4H; Ar H), 3.99 (br, 6H; CH2O, 2H; CH2OCO), 2.14 (br, 1H; CHCOO), 1.25-1,85 (br, 14H; CH2), 0.96 (br, 6H; CH3).

P(LC)-block-p(NIPAAm): 125 mg (0.94 mmol) of poly(LC), 53.2 mg (0.47 mmol) NIPAAm and 0.2 mg (0.0012 mmol) AIBN were dissolved in 1 mL of water-free dioxin. The reaction mixture was degassed by four freeze-pump-thaw cycles and the polymerization was carried out in a Schlenk tube under argon atmosphere at 70 °C over night. The resulting polymer p(LC)-block-p(NIPAAm) (59.8 mg, 34%) was precipitated for three times in a hexane:THF solution (2:1) and dried in vacuo.

^{1}H NMR (400 MHz, CDCl3, δ): 7.99 (br, 4H; Ar H), 7.74 (br, 1H; Ar H), 7.36 (br, 1H; Ar H), 7.12 (br, 1H; Ar H), 6.82 (br, 4H; Ar H), 3.99 (br, 6H; CH2O, 2H; CH2OCO), 1.40-2.09 (br, 19H; CH2), 1.14 (br, 6H; CH3) 0.93 (br, 6H; CH3).

Analysis:

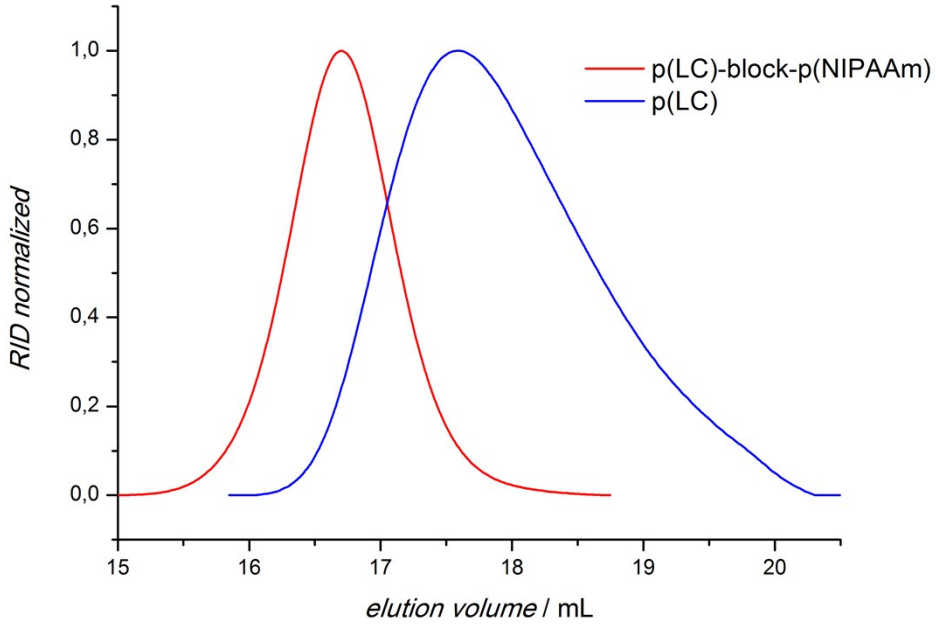


Figure S1. GPC elution curves of p(LC) and p(LC)-block-p(NIPAAm).

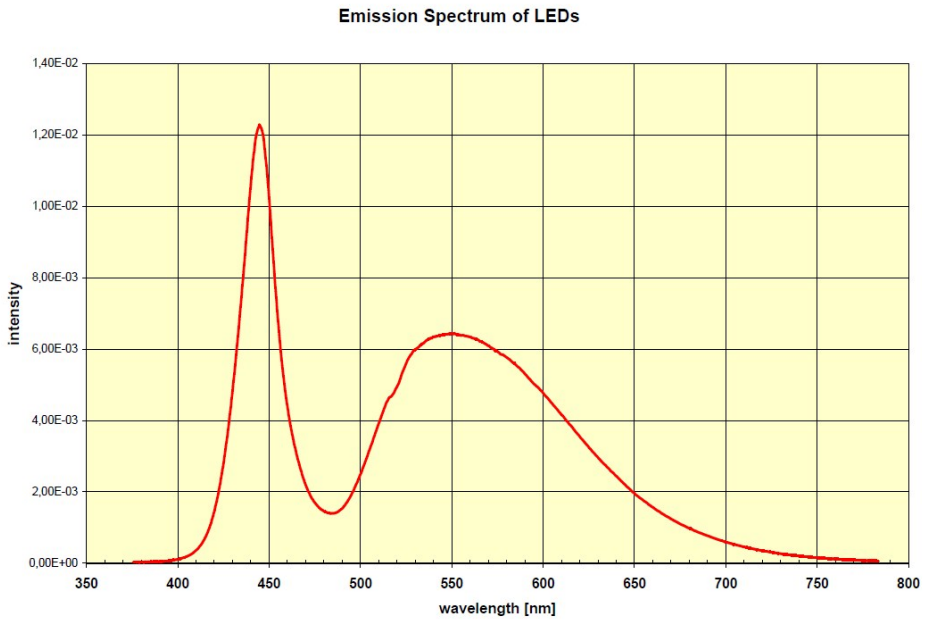


Figure S2. Emission spectrum of the coldlight source that was used to induce photoresponsive actuation. (Kindly provided by Schott AG)

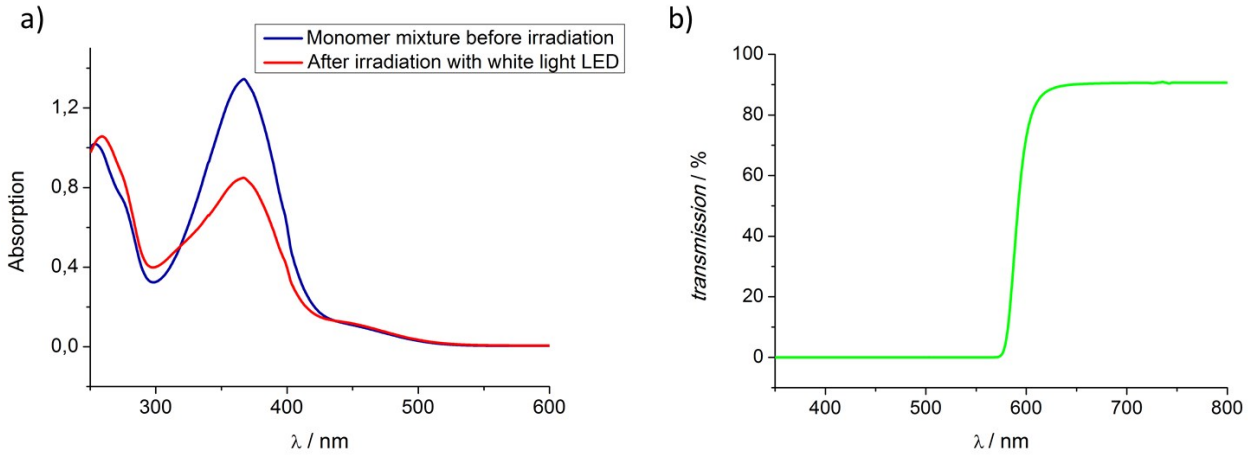


Figure S3. a) UV-vis spectrum of the monomer mixture before and after irradiation with the white light LED which was used to induce photoactuation. b) Transmission spectrum of the red light filter which was used to induce photoresponsive back-deformation.