Polymer-surfactant complexation as a generic route to responsive viscoelastic nanoemulsions

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Electronic Supplementary Information

Figure S1. Thermal rheology ($G'$, closed symbols; $G''$, open symbols) of nanoemulsions and PEG/SDS mixture from 5 °C to 55 °C at 1% strain and 20 rad s$^{-1}$ frequency. The nanoemulsions (black and squares) contain $\phi = 0.33$ PDMS droplets in water with $P=0.33$ PEGDME and $C_s=100$ mM SDS. The nanoemulsions (blue and circles) contain $\phi = 0.33$ PDMS droplets in water with $P=0.33$ PEGDA and $C_s=100$ mM Tween20. PEG/SDS mixture (red and triangles) contains $P=0.33$ PEGDA and $C_s=100$ mM SDS in water.
**Figure S2.** Dynamic strain sweep measurement for nanoemulsions containing $\Phi = 0.33$ PDMS droplets in water with $P=0.33$ PEGDA and $C_s=100$ mM SDS at 20 rad s$^{-1}$ frequency and the temperature indicated.

![Dynamic strain sweep measurement](image1)

**Figure S3.** Arrhenius plot of viscosity for the PEGDA/SDS mixtures. PEG/SDS mixture contains $P=0.33$ PEGDA and $C_s=0$ (squares), 100 (circles) and 150 (triangles) mM SDS in water. Lines are fits to the Arrhenius equation to extract activation energy, $E_a$, which are 10.0±0.29, 10.5±0.33 and 10.5±0.25 k_B T at 25°C, respectively.

![Arrhenius plot of viscosity](image2)

**Figure S4.** Intermediate scattering functions for $\Phi=0.01$ measured at $T=35$ °C, 25 °C, 15 °C and 5 °C. Solid lines are fits to stretched exponentials.

![Intermediate scattering functions](image3)
Figure S5. Intermediate scattering functions for $\phi=0.20$ measured at T=35°C, 25°C, 15°C and 5°C. Solid lines are fits to stretched exponentials.

Figure S6. $q$-dependence of average relaxation times for $\phi=0.01$ (circles) and $\phi=0.20$ (squares). The measurements were done at 35°C (red), 25°C (purple), 15°C (blue) and 5°C (cyan). Lines are power-law fits, $\langle \tau \rangle \sim (q^2)^\gamma$, to the data.
Figure S7. Intermediate scattering functions probed at $q = 24.67 \text{ µm}^{-1}$ (red), $22.30 \text{ µm}^{-1}$ (dark green), $19.25 \text{ µm}^{-1}$ (blue), $15.62 \text{ µm}^{-1}$ (purple) and $11.51 \text{ µm}^{-1}$ (black). Grays lines are fits to Eq. 1.
Figure S8. q-dependence of average relaxation times (circles for $<\tau_1>$ and squares for $<\tau_2>$) at $T=35$ °C (red) and 30 °C (purple). Lines are fits to $<\tau_i> \sim (q^2)^\gamma$.

Figure S9. Temperature dependence of the amplitudes of the fast mode (circles) and the slow one (squares). $\phi=0.33$.
Figure S10. Exponents of stretched exponentials for \( \phi = 0.01 \) (triangles), 0.20 (diamonds) and 0.33 (circles for the fast mode and squares for the slow mode).

Figure S11. Dependence of z-average diameter of droplet on SDS concentration. The nanoemulsions contain \( \phi = 0.33 \) PDMS droplets in water with \( P = 0.33 \) PEGDME and varying SDS. The samples were homogenized at 5 kspi for 20 passes. Inset photos: turbid nanoemulsions containing low SDS concentration \( C_s = 75 \text{mM} \) (left) and transparent nanoemulsions containing SDS above \( C_c = 80 \text{mM} \) (right).