Electronic Supplementary Material (ESI) for Soft Matter

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

Juntae Kim, Yongxiang Gao, Casey Hebebrand, Elke Peirtsegaele and Matthew E. Helgeson*

Electronic Supplementary Information

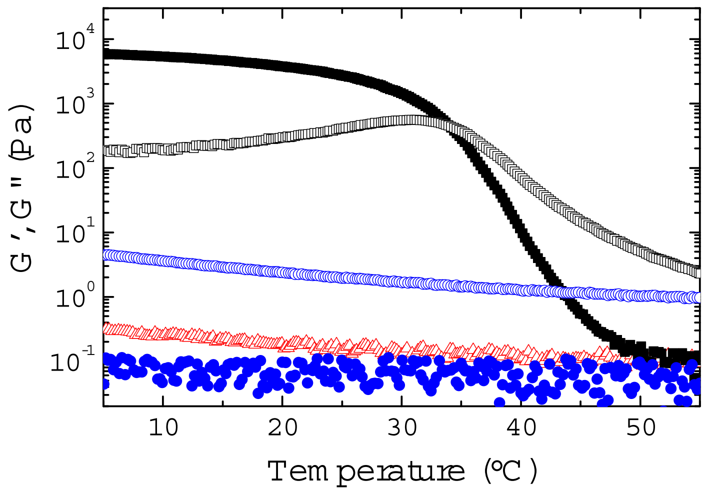

Figure S1. Thermal rheology (G', closed symbols; G", open symbols) of nanoemulsions and PEG/SDS mixture from 5 °C to 55 °C at 1% strain and 20 rad s^{-1} frequency. The nanoemulsions (black and squares) contain ϕ = 0.33 PDMS droplets in water with P=0.33 PEGDME and C_s=100 mM SDS. The nanoemulsions (blue and circles) contain ϕ = 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.

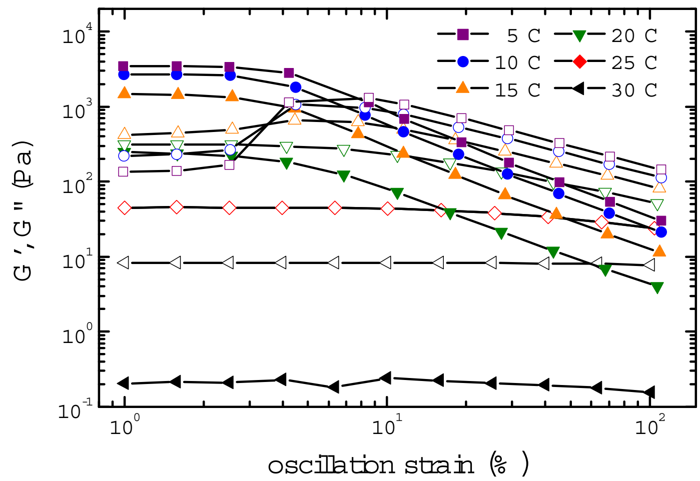

Figure S2. Dynamic strain sweep measurement for nanoemulsions containing ϕ = 0.33 PDMS droplets in water with P=0.33 PEGDA and C_s=100 mM SDS at 20 rad s^{-1} frequency and the temperature indicated.

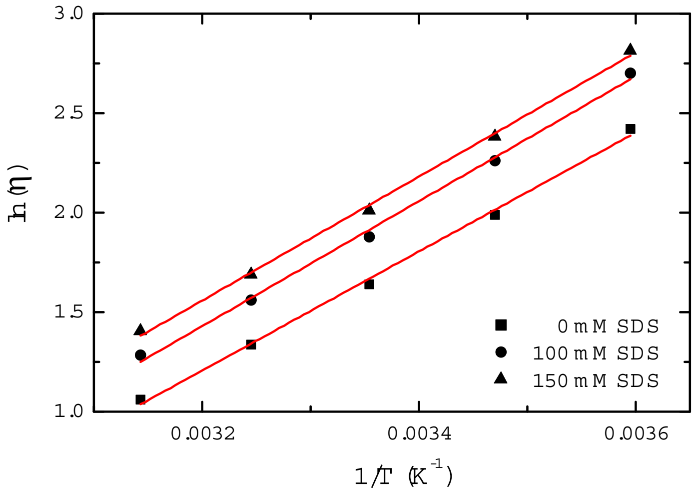

Figure S3. Arrhenius plot of viscosity for the PEGDA/SDS mixtures. PEG/SDS mixture contains P=0.33 PEGDA and C_s=0 (squares), 100 (circles) and 150 (triangles) mM SDS in water. Lines are fits to the Arrhenius equation to extract activation energy, E_a, which are 10.0±0.29, 10.5±0.33 and 10.5±0.25 k_bT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

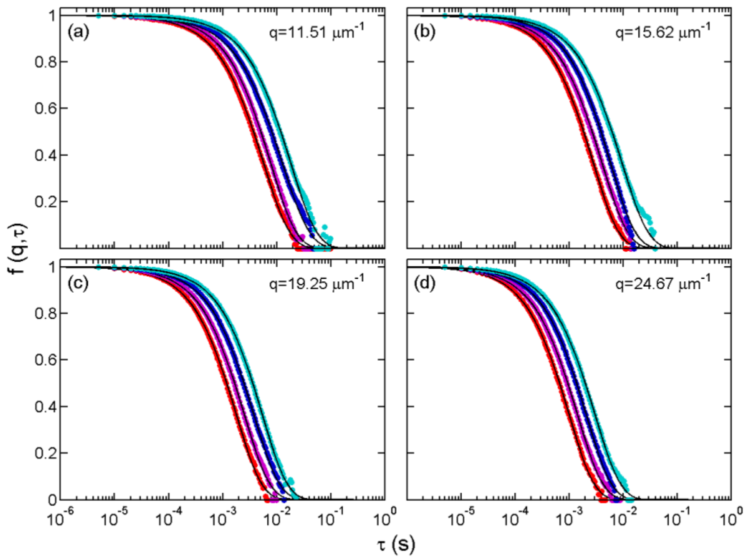

Figure S4. Intermediate scattering functions for φ=0.01 measured at T=35 °C, 25 °C, 15 °C and 5 °C. Solid lines are fits to stretched exponentials.

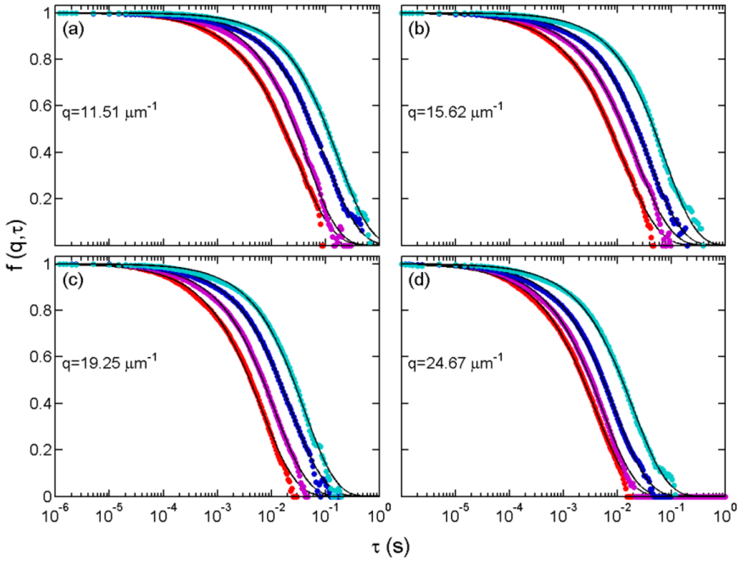

Figure S5. Intermediate scattering functions for φ=0.20 measured at T=35 °C, 25 °C, 15 °C and 5 °C. Solid lines are fits to stretched exponentials.

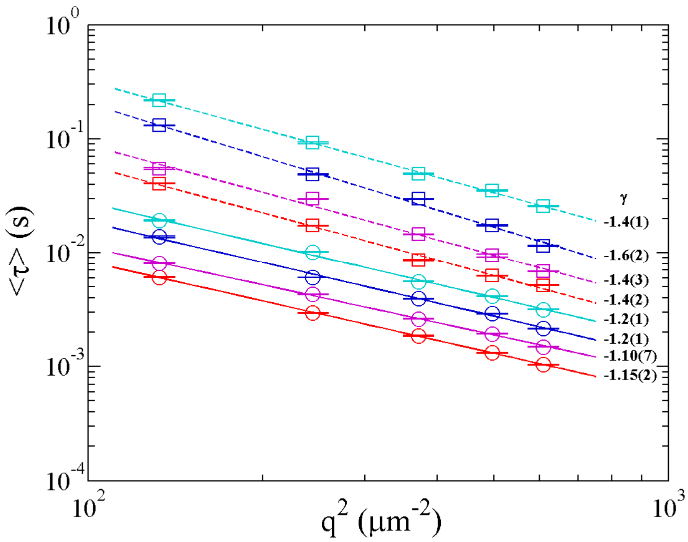

Figure S6. q-dependence of average relaxation times for φ=0.01 (circles) and φ=0.20 (squares). The measurements were done at 35 °C (red), 25 °C (purple), 15 °C (blue) and 5 °C (cyan). Lines are power-law fits, $< \tau > \sim (q^2)^\gamma$, to the data.

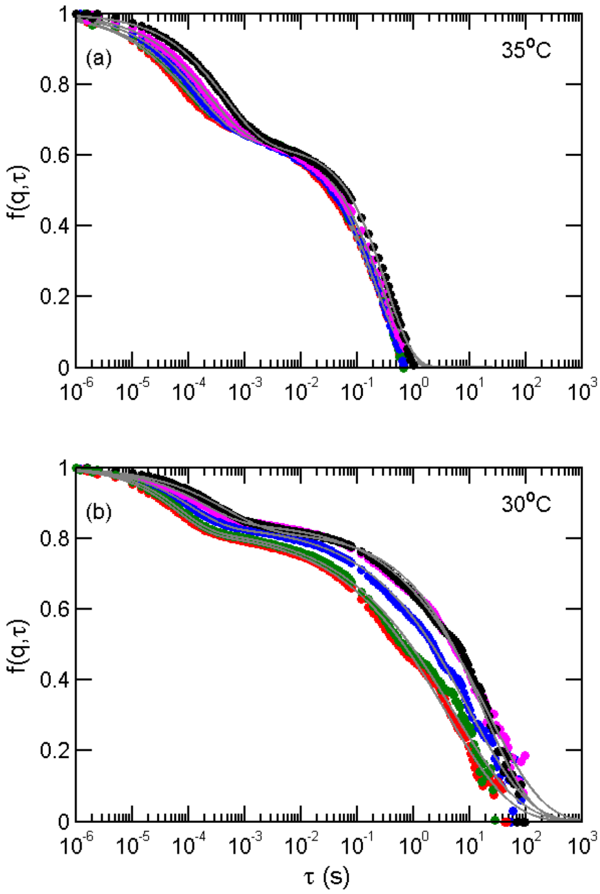

Figure S7. Intermediate scattering functions probed at q=24.67 μm^{-1} (red), 22.30 μm^{-1} (dark green), 19.25 μm^{-1} (blue), 15.62 μm^{1} (purple) and 11.51 μm^{-1} (black). Grays lines are fits to Eq. 1.

Electronic Supplementary Material (ESI) for Soft Matter

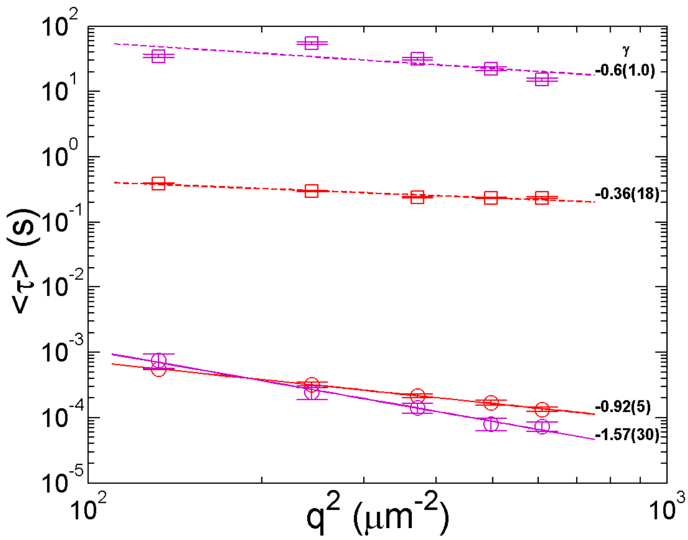

Figure S8. q-dependence of average relaxation times (circles for $<\tau_1>$ and squares for $<\tau_2>$) at T=35 °C (red) and 30 °C (purple). Lines are fits to $< \tau_i > \sim (q^2)^{\gamma}$.

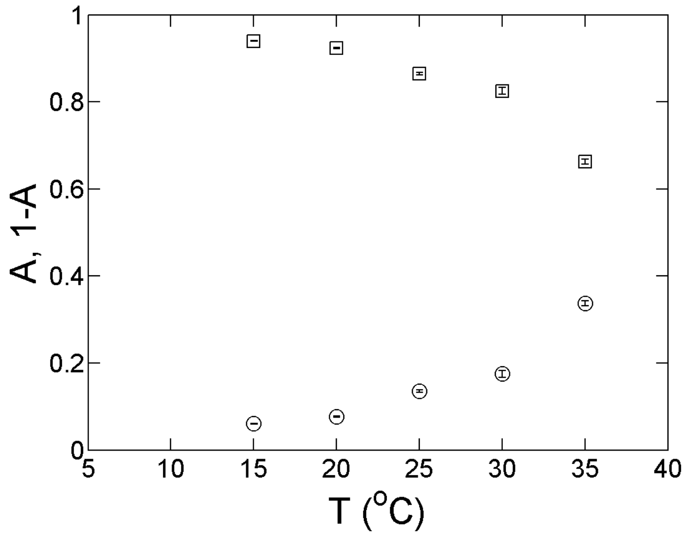

Figure S9. Temperature dependence of the amplitudes of the fast mode (circles) and the slow one (squares). φ=0.33

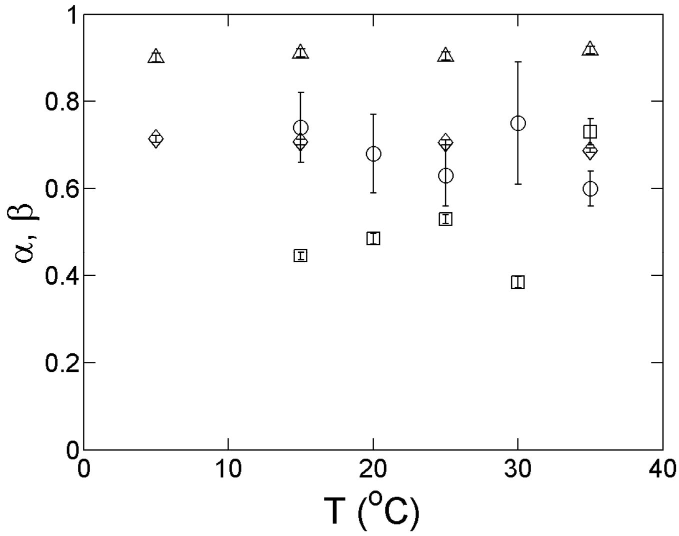

Figure S10. Exponents of stretched exponentials for φ=0.01 (triangles), 0.20 (diamonds) and 0.33 (circles for the fast mode and squares for the slow mode)

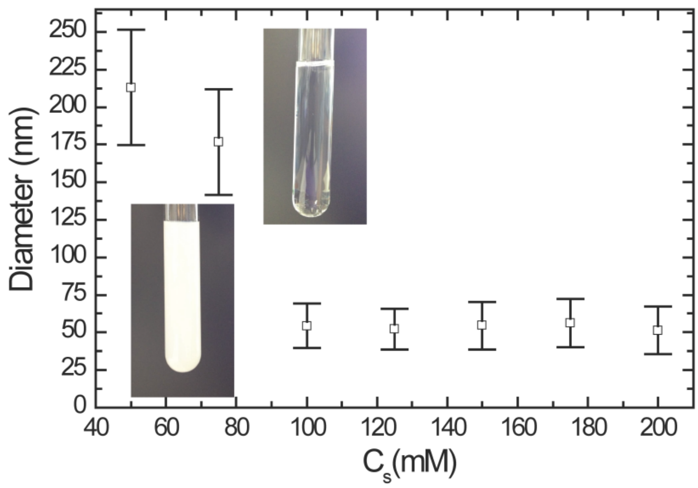

Figure S11. Dependence of z-average diameter of droplet on SDS concentration. The nanoemulsions contain ϕ = 0.33 PDMS droplets in water with P=0.33 PEGDME and varying SDS. The samples were homogenized at 5 kspi for 20 passes. Inset photos: turbid nanoemulsions containing low SDS concentration C_s=75mM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