Supporting Information for

Lamellar-to-Onion Transition with Increasing Temperature under Shear Flow
in a Nonionic Surfactant/Water System

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Figure 1. Apparatus for simultaneous measurements of small-angle light scattering/shear stress (Rheo-SALS). The Couette cell made of quartz consists of two concentric cylinders whose diameters are 48 mm and 50 mm. The height of the inner cylinder is 21 mm. The rotation speed of the outer cylinder and measurements of torque applied to the inner cylinder are controlled by a rheometer NRM-2000 (Nihon Rheology Kiki). The temperature of the cell is controlled to ±0.1°C by Peltier elements and a heater in an air bath. To prevent sample evaporation, a vapor seal is incorporated in the cell. A He-Ne laser (NEC GLG5360, 5 mW at 632.8 nm) is used as a light source. The horizontally polarized beam, is passed along the velocity gradient axis of the Couette cell (corresponding to the radial configuration) and through an analyzer. The intensity of scattered light is detected by a CCD camera system (Hamamatsu Photonics C4880-80-22A) for both polarized (HH) and depolarized (VH) scattering. The exposure time was 6.6 ms. The approximate $q$-range is from 0.5 to 2 $\mu$m$^{-1}$. 
Figure 2. Evolution of shear stress (circles) at the shear rates of 1 s$^{-1}$ (a) and 3 s$^{-1}$ (b) with a stepwise increase in temperature (solid lines) for the sample containing 48 wt% C$_{16}$E$_7$ in D$_2$O in the Rheo-SALS measurements. The symbols on the upper abscissa in (b) indicate that the shear stress exceeds a limit of our apparatus (16.5 Pa).
Figure 3. Evolution of shear stress at 65°C (open squares), 67°C (closed triangles), and 75°C (open circles) with a stepwise increase in shear rate (solid line) for the sample containing 48 wt% C₁₆E₇ in D₂O in the Rheo-SALS measurements. The symbols on the upper abscissa indicate that the shear stress exceeds a limit of our apparatus (16.5 Pa).

Figure 4. Evolution of shear stress (thick line) at the shear rates of 3 s⁻¹ with a stepwise increase in temperature (thin line) for the sample containing 48 wt% C₁₆E₇ in D₂O in the Rheo-SAXS measurements.
Figure 5. Azimuthal intensity distributions recorded at the Bragg peak position in the radial configuration in the Rhe-SAXS measurements. The flow direction is set to 0°. The temperature and shear stress for the plots (a)-(g) are shown in Figure 9 of the main text (the same letter indicates the same temperature). The base lines for (b) - (g) are shifted by a constant value (0.2) from that of (a). At higher temperatures, additional peaks appear at 0°, ~70°, ~110°, and 180°, which may be precursor of the transition into the long-range-ordered structures reported for other systems.\textsuperscript{6, 22} However, we did not observe peaks at 240° and 300° in the azimuthal intensity distribution (see the arrows) which should appear in the long-range-ordered structure.
Figure 6. Phase diagrams of C\textsubscript{10}E\textsubscript{3}/water (a) and C\textsubscript{16}E\textsubscript{7}/water (b) systems at rest adapted from ref 15 and 37, respectively, and schematic phase diagram of C\textsubscript{n}E\textsubscript{m}/water system in a wide temperature range (c). L\textsubscript{1}, micellar phase; L\textsubscript{2}, inverse micellar phase; L\textsubscript{3}, sponge phase; W, dilute micellar phase; H\textsubscript{1}, hexagonal phase; V\textsubscript{1}, bicontinuous cubic phase; L\textsubscript{\alpha}, lamellar phase. The inverse triangle in (a) and triangles in (b) indicate the lamellar-to-onion transition temperature with decreasing and increasing temperature, respectively (see Table 1 and Figure 1a in the main text). It should be noted that the temperature and concentration range of the phase diagrams in (a) and (b) may correspond to the upper and lower squares in (c), respectively. These results suggest the existence of a closed-loop region (shown by the dotted ellipsoid in (c)) where onions can be formed under constant shear rate.