# Supporting Information: Lamellar-to-MLV transformation in SDS/octanol/brine examined by microfluidic-SANS and polarised microscopy

Liva Donina, Aysha Rafique, Sepideh Khodaparast, Lionel Porcar, and João T. Cabral*

October 18, 2021

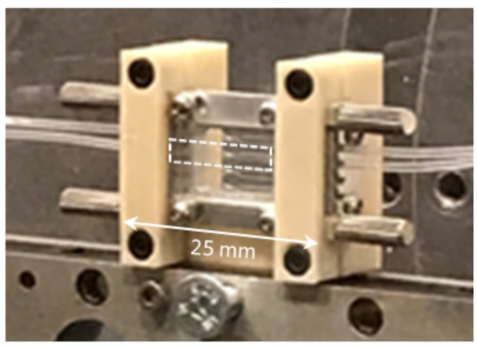



Figure S1: A custom 3D printed holder was fabricated to firmly mount the chip to ensure position stability and repeatability during xy scans. The location of the microchannel is highlighted by the dashed rectangle.

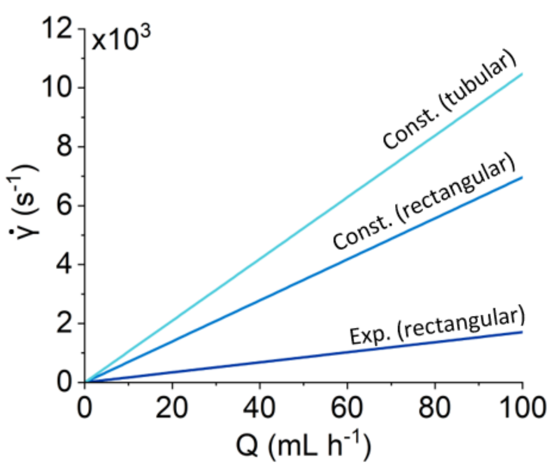



Figure S2: Wall shear rate calculations based on Son's approach in channel constriction , assuming a circular ($R =$ 0.15 mm), *Const. (tubular)*, and rectangular cross-section ($H = 0.3$ mm, $W = 0.3$ mm), *Const. (rectangular)*, as well as in the wider section of the channel, *Exp. (rectangular)* ($H = 0.3$ mm, $W = 1.0$ mm).

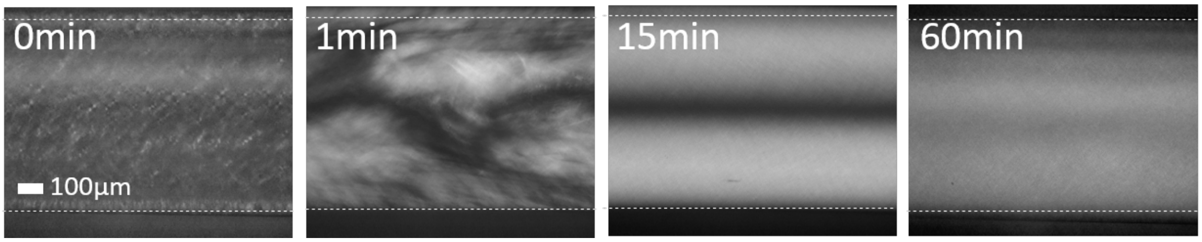
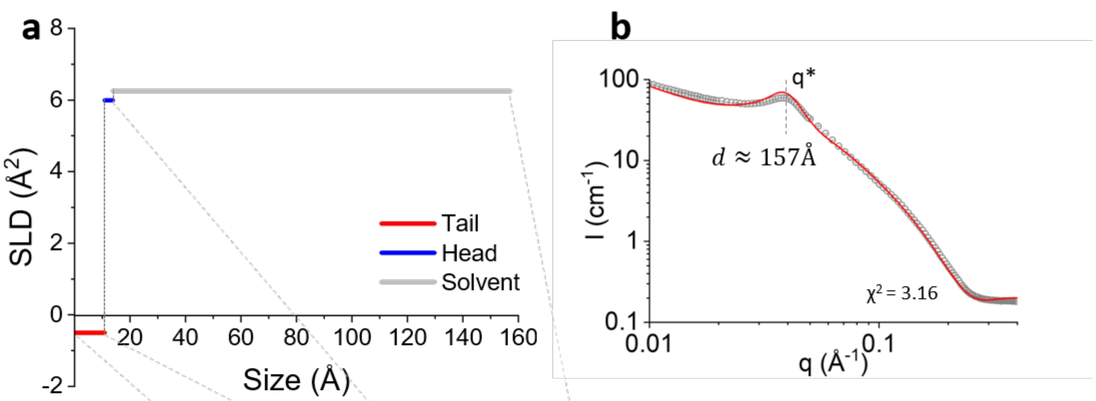
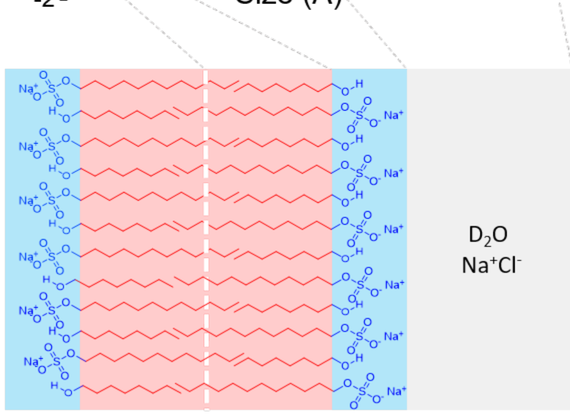



Figure S3: Optical texture evolution observed in a tubular geometry (FEP tubing, diameter $d = 0.79$ mm, length $l = 1.5$ m) at 5 mL h$^{-1}$.




c

| Parameters | Values | Units |
|---|---|---|
| Scale | 0.81 | |
| Background | 0.2 | cm$^{-1}$ |
| Length (tail) | 10.9 | Å |
| Length (head) | 2.9 | Å |
| N Layers | 1000 | |
| d_spacing | 156.8 | Å |
| Caille parameter | 1 | |
| SLD (Tail) | -0.5 | 10$^{-6}$/Å |
| SLD (Head) | 5.99 | 10$^{-6}$/Å |
| SLD (Solvent) | 6.28 | 10$^{-6}$/Å |

Figure S4: a) Neutron scattering length density profile for the lamellar stack and schematic of the double layer; b) Scattering data (quiescent) and fitted model; c) Representative fitting parameters obtained by the Caillé structure factor model with SASView.

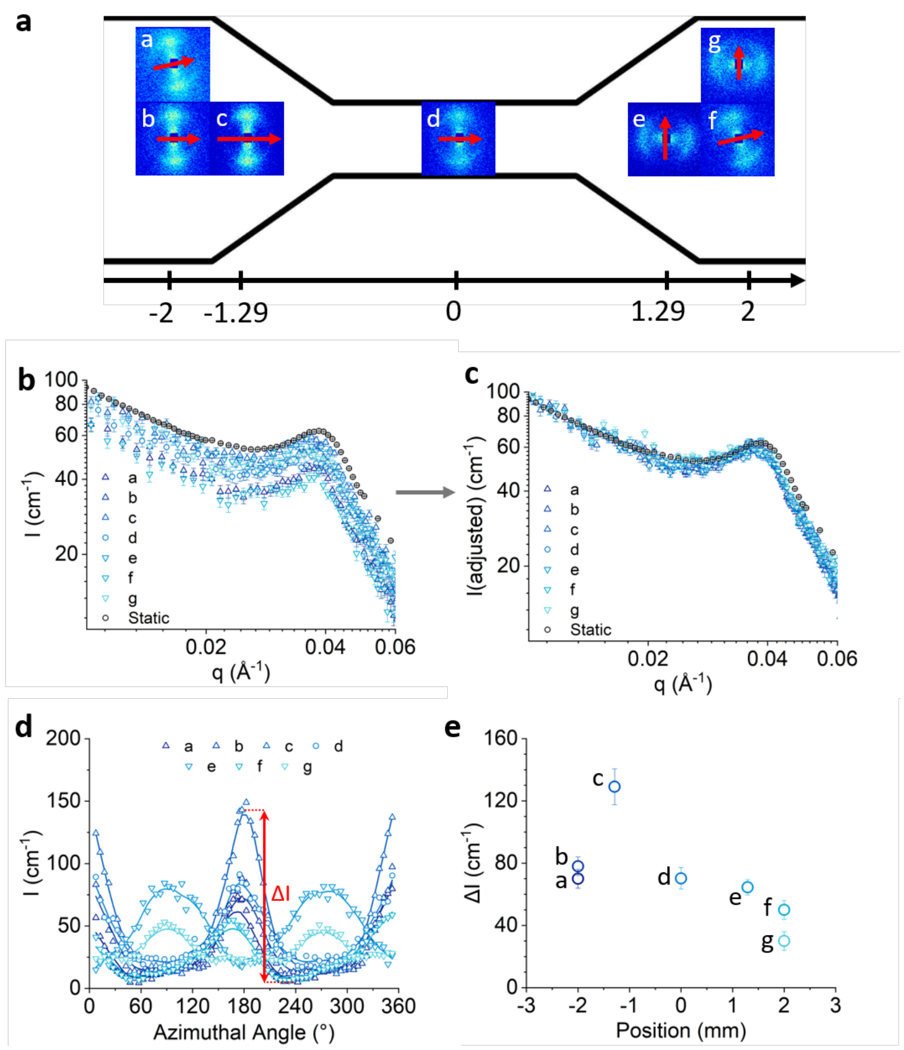



Figure S5: **Lamellar phase alignment along the contraction-expansion microfluidic chip subjected to 5 mL h$^{-1}$ flow rate** a) 2D scattering patterns along the chip; b) Radially-averaged SANS intensity acquired at the positions a, b, c, d, e, f and g of the contraction-expansion geometry, at flow rates of 5 mL h$^{-1}$; c) Radially-averaged SANS intensity data collapsed on one curve to demonstrate that S(q) remains unchanged; d) Azimuthal average within 0.035 $\leq q \leq$ 0.045 Å$^{-1}$ computed from the 2D data shown in panel a), from where an orientation parameter $\Delta I$ is estimated from the difference between the maximum and minimum intensities as a function of azimuthal angle; e) $\Delta I$ in different positions along the channel. The x axis coordinate refers to the distance from the center of the channel.

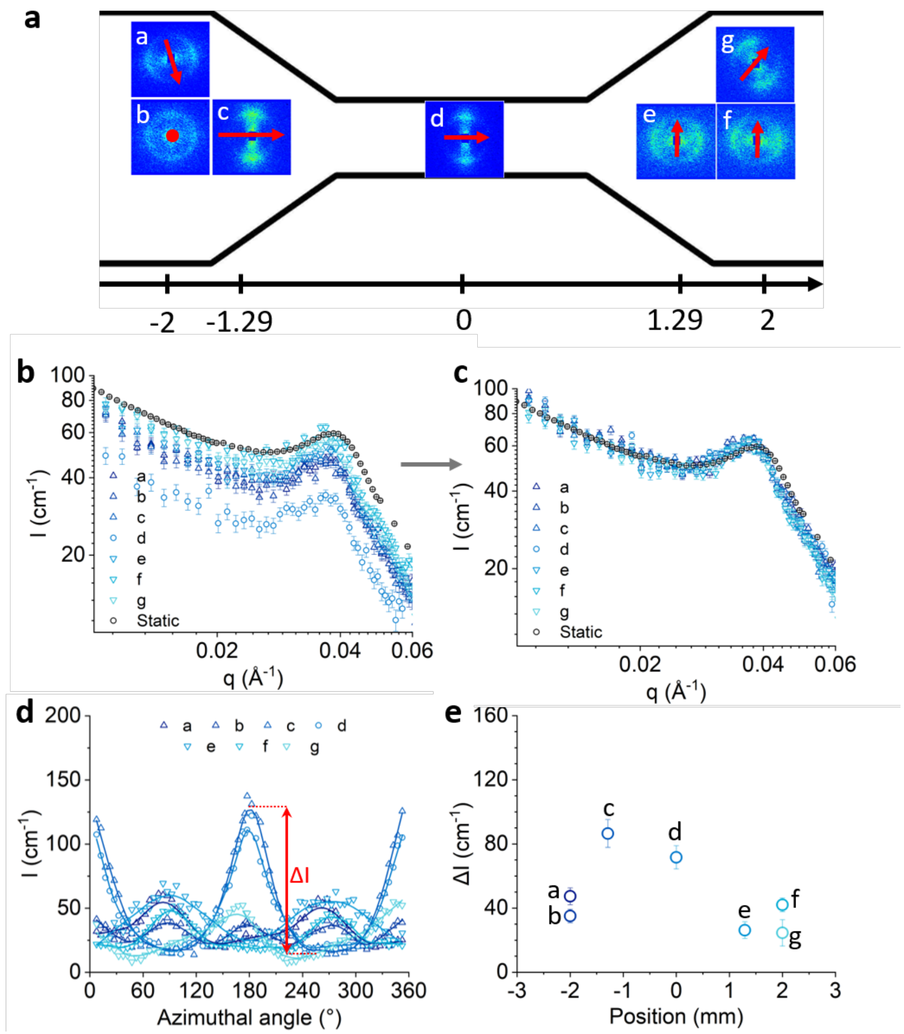



Figure S6: **Lamellar phase alignment along the contraction-expansion microfluidic chip subjected to 0.5 mL h$^{-1}$ flow rate**; a) 2D scattering patterns along the chip ; b) Radially-averaged 2D SANS intensity acquired at positions a, b, c, d, e, f and g of the contraction-expansion geometry, at flow rates of 0.5 mL h$^{-1}$; c) Radially-averaged SANS intensity data collapsed on one curve to demonstrate that $S(q)$ remains unchanged; d) Azimuthal average within 0.035 $\leq q \leq$ 0.045 Å$^{-1}$ computed from the 2D data shown in panel a), from where an orientation parameter $\Delta I$ is estimated from the difference between the maximum and minimum intensities as a function of azimuthal angle; e) $\Delta I$ in different positions along the channel. The $x$ axis coordinate corresponds to the distance from the center of the channel.

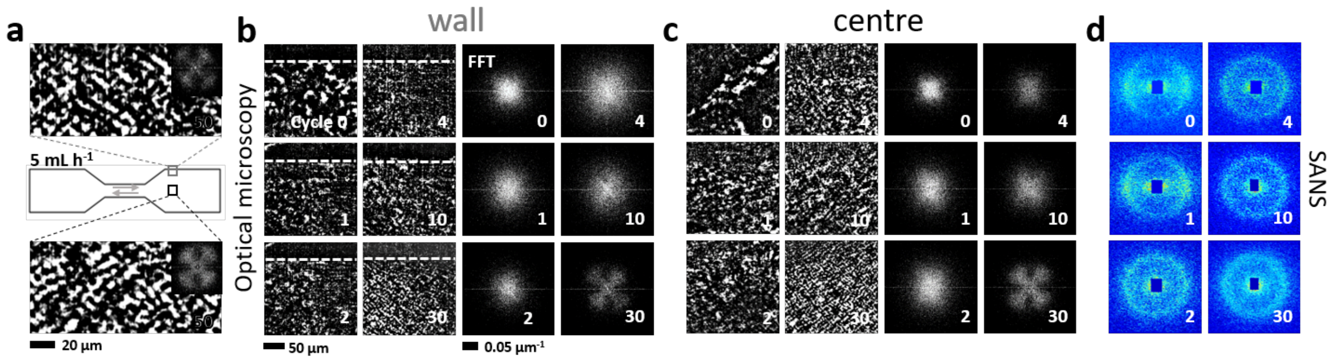



Figure S7: **Optical texture changes near the wall and in the middle of the channel** for an oscillatory shear experiment performed at 5 mL$^{-1}$h; a) Sheared sample after 1 h of shearing at the wall vs. centre. The size of the squares is to the scale of image analysed; b) Evolution of the optical pattern and the corresponding FFTs measured near the wall; c) Evolution of the optical pattern and the corresponding FFTs in the middle of the channel; d) Corresponding 2D SANS patterns.

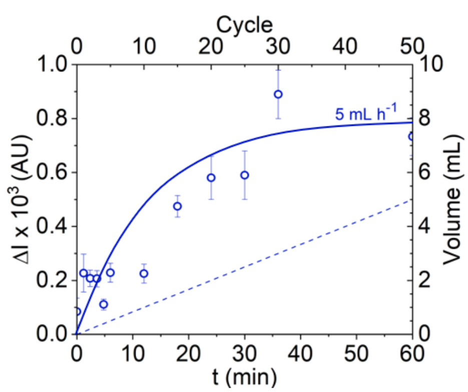



Figure S8: **Effect of microfluidic oscillatory shear flow** at 5 mL h$^{-1}$ on $L_\alpha$ phase over multiples cycles from 0-30 (shown here).

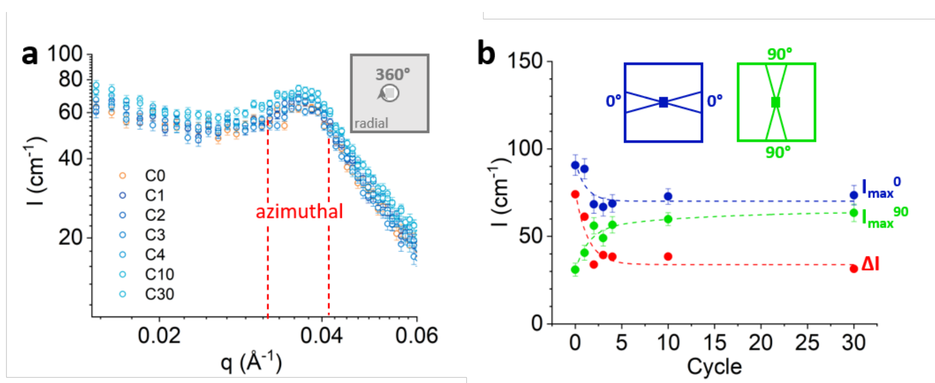



Figure S9: **Oscillatory flow SANS analysis.** a) Radially-averaged 2D SANS intensity acquired after oscillatory shear cycles 0, 1, 2, 3, 4, 10 and 30 applying 5 mL h$^{-1}$ volumetric flow rate and 50$\mu$L volume amplitude; b) Summary of the parameters extracted, $\Delta I$ (red), and $I_{max}$ at 0° (blue) and 90° (green) as a function of oscillatory shear cycles. Grey line represents radially-averaged 2D intensity peak maxima as a function of shear cycles.