Temperature Effects on Shear-Induced Structural Transition in the Lamellar Phase of a Nonionic Surfactant -Change in the Orientation of Lamellae-

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In the past 15 years, much attention has been paid to the effects of shear flow on the structure of a lamellar phase owing to the development of the apparatus which enables us to determine their structures directly under shear flow. In the previous studies, we have measured small angle neutron scattering (SANS) on the lamellar phases of a nonionic surfactant C16H33(OC2H4)7OH (C16E7) in D2O at 70C under shear flow with shear rate of 0.01 - 10 s-1. We have found anomalous decrease in the lamellar spacing (d) for the shear rate of 0.1-1 s-1 [1-3]. In addition, abrupt change of d has been observed at around 70C when the temperature is raised from 60C to 80C. In the present study, we have investigated effects of temperature in more detail focusing on the change in the azimuthal intensity distribution.

Measurements of SANS were carried out at the instrument SANS-U of Institute for Solid State Physics of University of Tokyo in JRR-3M at Tokai with a Couette shear cell [4].

Figure 1a shows azimuthal intensity distribution for the shear rate of 3 s-1 at different temperatures and at 48 wt% of C16E7. At 60C, the lamellae is oriented to the neutral direction (90 and 270 degree) after the application of shear flow. The orientation becomes even more strong at 71 C. In Figure 1b, temperature dependences of the peak intensity for the neutral and flow direnctions are presented. This figure demonstrates that the orientation of lamellae becomes abruptly strong at 71 C and then changes towards isotropci orientation with the further increase in temperature. It should be noted that the repeat distance also abruptly increases at 71C as described in the previous report. These results suggest lamellar to onion transition with increasing temperature, which is not observed at rest.

References
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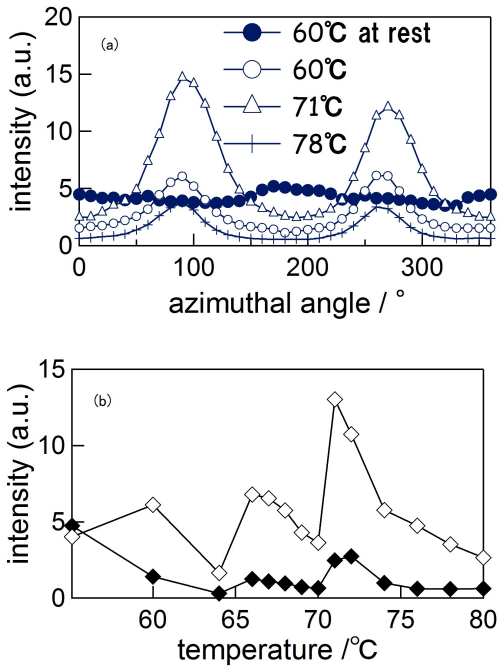

Fig. 1. Azimuthal intensity distribution at different temperatures (a) and temperature dependences of the peak intensity for the neutral (open diamond) and flow (closed diamond) direnctions (b) at the shear rate of 3 s-1 and at 48 wt% of C16E7.