Director/Barycentric rotation in cholesteric droplets under heat flow

Jun Yoshioka, Fumiya Ito and Yuka Tabe

In the cholesteric (Ch) phase, director rotates when temperature gradient is applied along its helical axis, which is called Lehmann rotation [1]. However, this phenomenon is poorly reproducible; the experimental verification for the Lehmann rotation isn’t enough yet. In this situation, recently, it was found the texture on the droplet formed by the Ch phase (Ch droplet) rotates under the temperature gradient [2]. In this study, to clarify its rotational mechanism, we analyzed the physical properties of the rotation in the Ch droplets using the polarized optical microscopy (POM) and flow-field measurements with the fluorescence photo-bleaching method.

Making the Ch droplets in the coexistence region of the isotropic (I) and the Ch (I+Ch) phase, we found the two types of droplets with stripe and concentric-circle (CC) texture appear as shown in Fig.1 (striped and CC-type droplets). Furthermore, rotational motions are induced in these two types of the droplets under the temperature gradient. To analyze the physical properties of these heat-driven rotational motions, we measured the chirality dependence of the rotational speed of these motions. As a result, we found the speed increases as the chirality increases in the CC-type droplets; this property is consistent with the Lehmann rotation. On the other hand, in the striped droplets, we found the rotational speed decreases as the chirality increases in contrast to the Lehmann rotation.

To analyze the physical properties of these heat-driven rotations further, we measured the flow-field of the system using the photo-bleaching method. As a result, we found the rotational flow according to the rotation of the texture is induced in the stripe-type droplet, while the director rotation is dominant in the CC-type droplet as well as the Lehmann rotation.

References


*E-mail: j-yoshioka@aoni.waseda.jp*