

Monitoring Two-Dimensional Concentration Profile of Organic Vapors by using Polymer-Stabilized Nematic Liquid Crystals in Microchannels

Supplementary Information

Phase change of pure LC 5CB and the mixture (5CB : RM257 : DMPA = 93.5 : 6.0 : 0.5)

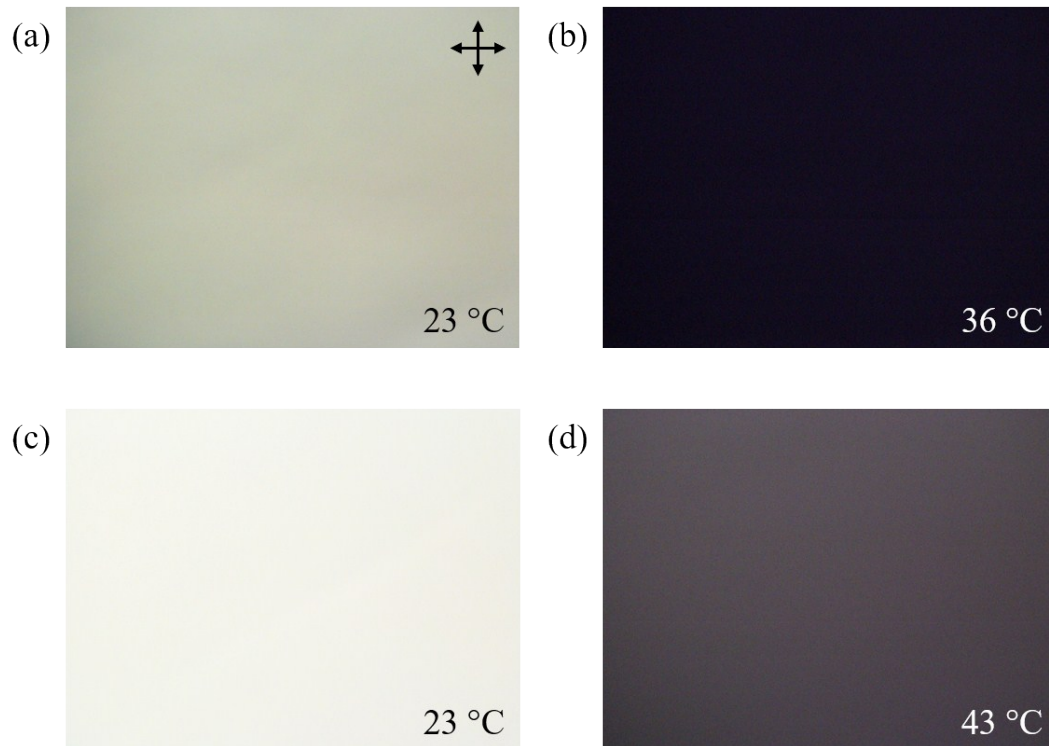


Fig. S1 Images of (a, b) pure 5CB and (c, d) mixture of 93.5% 5CB, 6% RM257 and 0.5% DMPA under crossed polarizers at different temperatures: (a) 23 °C (b) 36 °C (c) 23 °C and (d) 43 °C. Clearing temperature of pure 5CB and the 5CB mixture was determined to be 36°C and 43 °C, respectively.

Effect of Temperature on PSLC

The same PSLC sample was prepared on a piece of glass slide. A hot plate was used to heat up the sample on the glass slide. Changes in the appearance of the sample with increasing temperature from 23 °C to 180 °C were shown in Movie 3 in the Supplementary Information. Optical images of the PSLC sample under four different temperatures are shown in Fig. S2.

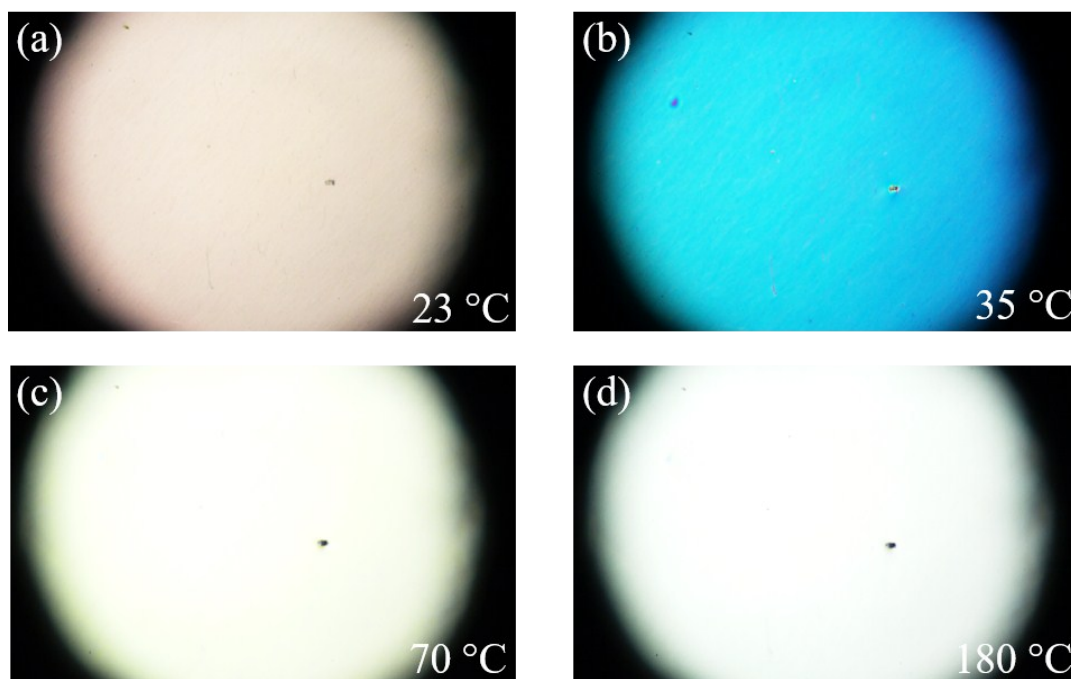


Fig. S2 Colors of the PSLC sample at (a) 23 °C, (b) 35 °C, (c) 70 °C, and (d) 180 °C.

At the room temperature (23 °C), 5CB in the PSLC had a planar orientation and showed a bright color under the POM as shown in Fig. S2a. When the temperature was increased, the color of the PSLC also changed accordingly. At 35 °C, the PSLC sample still showed a blue color (Fig. S2b) and did not enter the isotropic phase as pure 5CB. It suggests that the polymer network was able to stabilize 5CB and prevented it from entering the isotropic phase at 35 °C. The color of the PSLC sample kept changing until 70 °C. At this temperature, the color of the sample appeared white. We believe that the white color came from the polymer network instead of 5CB, which probably became isotropic completely at 70 °C. From 70 °C to 180 °C, the color of the sample remained unchanged. No further phase transition was observed in this temperature range.

To confirm the white color came from the polymer, we washed out 5CB from the PSLC by using toluene, leaving only the polymer network. Indeed, the polymer network showed a white color throughout the temperature range between 23 °C and 180 °C.

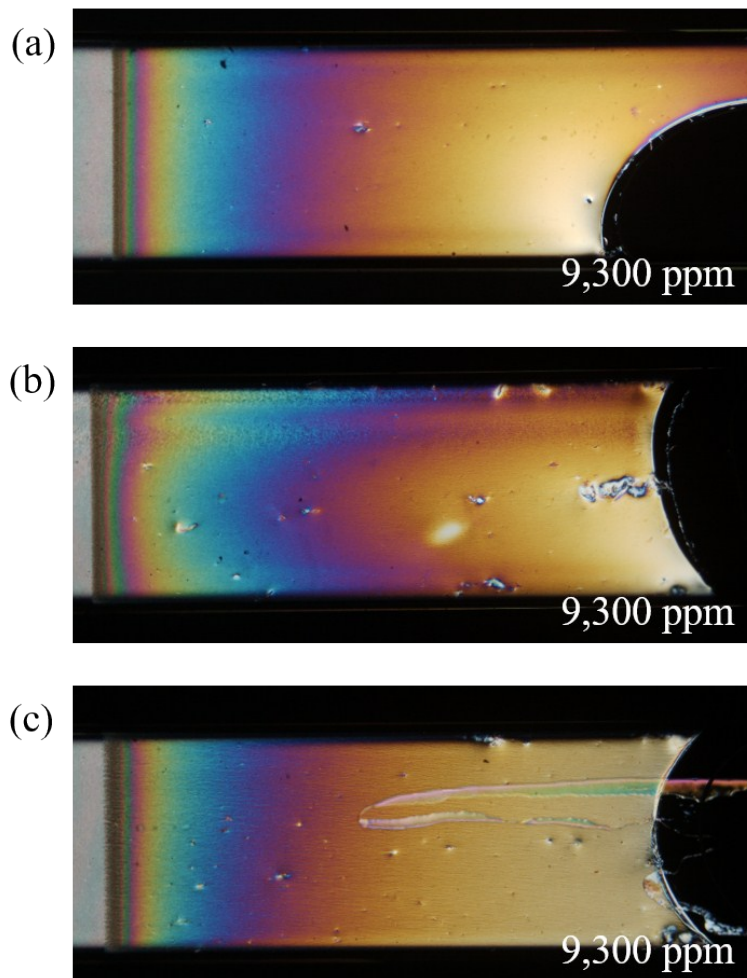


Fig. S3 Three samples were exposed to toluene vapor at 9,300 ppm at the same time for 15 h. Similar color gradients and diffusion length indicate that the experiments were reproducible with little sample variation.