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Nontrivial ultraslow dynamics under electric-field in nematics of bent-shaped molecules

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1. Phase transition behavior of COO_2

Figure 1 demonstrates the phase sequence of the COO_m and OCO_m (m=2,4,6) homologs. COO_m (m=4,6,8,10) homologs first enter the N_{TB} phase and then enter the crystal phase at low temperature. Unlike other COO_m (m=4,6,8,10) homologs, COO_2 exhibit does not exhibit the N_{TB} phase. In addition, it first exhibits a metastable crystal phase upon cooling since about 141°C, which then spans over a small area in the sample. When cooling from 141°C at a slow cooling rate as 5K min^{-1}, the crystal soon fill up the whole volume of the sample. While the cooling rate is fast more than 30 K min^{-1}, the spaning rate of the crystal is slow and the crystal phase can coexist with the N phase from 92°C (Fig. S1). The N_{TB} phase is known to induced only by flexible bent molecules. Thus, the flexible alkyl chain spacer plays important roles in phase transitions and stabilizing the N_{TB} phase. With decreasing the length of the flexible alkyl chain spacer, we expect the effective molecular flexibility provided by the spacer decreases. This likely replaces the N_{TB} phase with N or Cr phase for the shortest m=2 in the present two dimer systems. Therefore, to measure the physical properties of the N phase in COO_2, we choosed the uncrystallized areas.

2. Wavelength of stripe texture

Figure S1 demonstrates the stripe texture of COO_2, whose width changes almost linearly with the thicknesses of the sample, *d*. The stripe width is of the similar length order of *d*. For example, the widths of the stripes are 2.7 μm, 4.5 μm, and 6.4 μm for *d*=5.2 μm, 8.5 μm, and 10.5 μm, respectively. They are nearly half of *d*.

3. Response of COO_2 to high amplitude electric field

Figures S2a-c show the Freedericksz transition of COO_2 at 75°C from the initial planar state to a homeotropic state in 15 seconds under a square-wave electric field. At 65°C, the electro-optical response comprises three processes as shown in Figs. 5e-g. The stripes developed from the uniform state are a nonequilibrium state, which eventually returns back to the uniform state. However, at 62°C, the stripes are rather disordered and grow very slow and retain for more than 10 hours.

4. Supporting figures

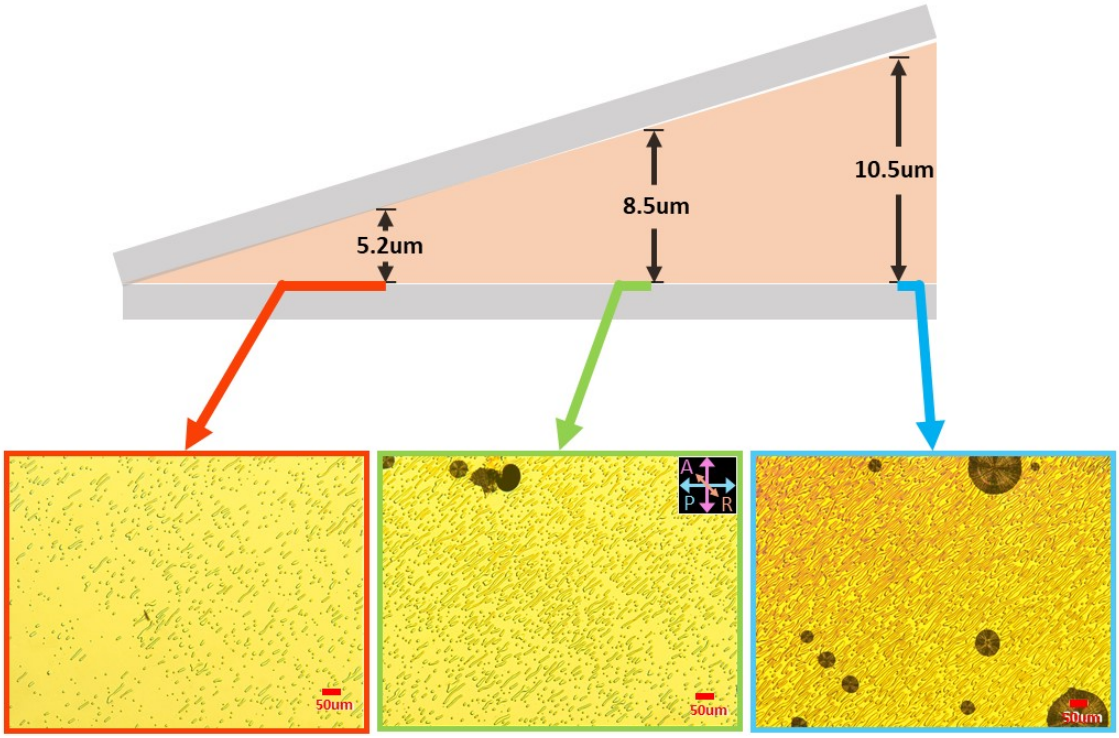

Fig. S1. Stripe texture of COO_2 under 65 °C at the different thicknesses of the wedge cell as indicated. The thickness of the wedge cell is ranging from 4.5 μm to 10.5 μm measured by the optical interference method. The rubbing direction is oriented at -45 degrees from the crossed polarizers as indicated.

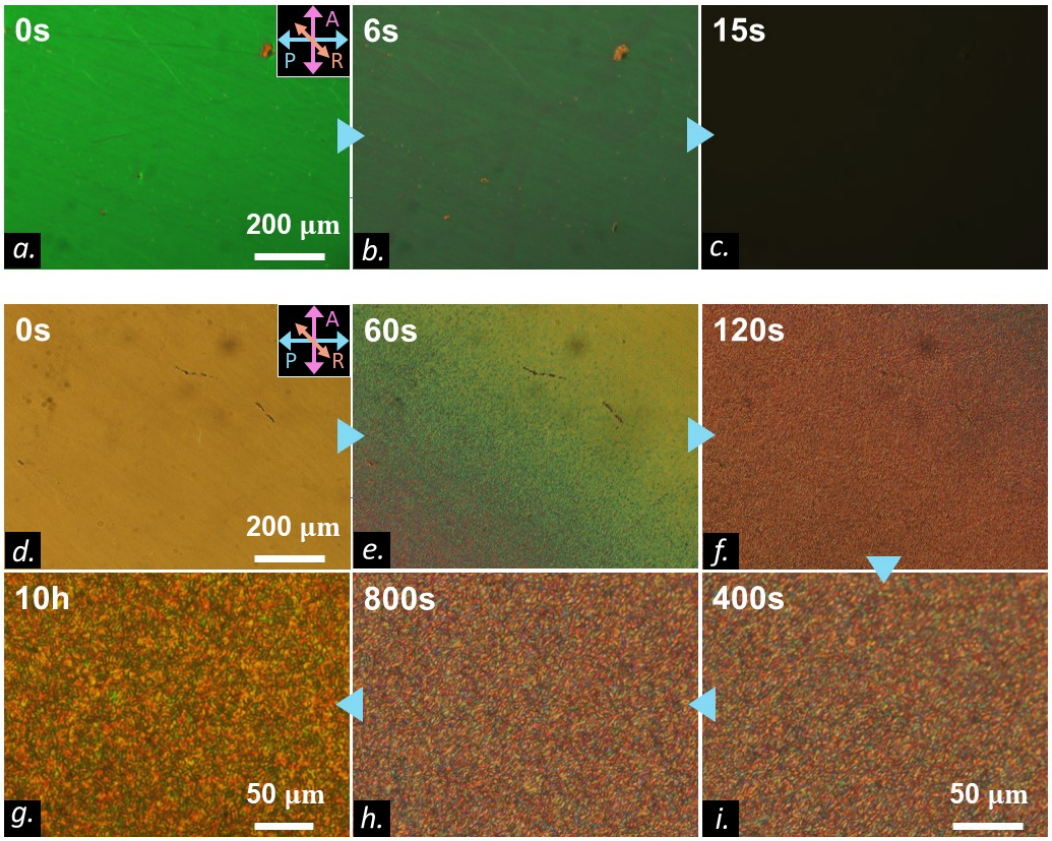

Fig. S2. PLM images upon the application of a 20-V square-wave in an antiparallel-rubbing cell of COO_2 at 75°C (a-c) and 62°C (d-i). The rubbing direction is oriented at -45 degrees from the crossed polarizers as indicated.