Supplementary Material (ESI) for Soft Matter

Experimental

The azo-LCNs detailed here were prepared by thermal copolymerization of two azobenzene liquid crystal monomers 6-4-(4-hexyloxyphenylazo)phenoxyhexyl acrylate (1azo, A6AB2) and 4,4'-bis[6-(acryloyloxy)hexyloxy]azobenzene (2azo, DA6AB).[1, 2] 1azo and 2azo were mixed in a 9:1 molar ratio similar to previous work. Thermal polymerization was initiated with 1.2 wt% AIBN. Samples were cured for 6 hours at 85.5°C between glass slides coated with Elvamide, rubbed antiparallel, and spaced with predominately 50 μm spacers, although 20 μm and 40 μm thick azo-LCNs were also studied.

The images presented in Figures 1b, 2a, 2c, 3b, 4 and 5 as well as supplemental videos were captured with a FUJI S7000 photocamera. The camera operates with an exposure time of 33.3 ms. The frequency of the photodriven oscillation of the azo-LCN cantilever was measured with a photodetector and an oscilloscope. Taking advantage of the absorptive properties of the azo-LCN, the photodetector was positioned such that the azo-LCN would accordingly block light based on its position. At maximum displacement, the laser light was transmitted directly through a neutral density filter into the photodetector resulting in the intensity maximums seen in Figure 2b. At minimum displacement (approximately 40°), the azo-LCN absorbs the light and therefore prevents most of the light from reaching the photodetector, resulting in the intensity minimums in Figure 2b. The resulting measurement was periodic and used to determine the oscillation frequency of the azo-LCN cantilever. Measured frequencies were corroborated with a strobe flash and image analysis. The position of the azo-LCN was also determined utilizing a strobe flash and a framegrabber (Panasonic). As evident in Figures 1b, 2a, 2c, 3b, 4 and 5 ; the speed of moving cantilever causes the camera to captures the complete amplitude of the film. We therefore used a strobe flash with 2.5 ms white light pulses operating at a known frequency (slightly slower than the oscillation frequency of the azo-

LCN cantilever), the frequency of the oscillating azo-LCN (measured by oscilloscope), and the capture frequency of the framegrabber to determine the position of the azo-LCN as a function of image number. Deriving periodicity of the azo-LCN oscillation from Figure 2b and imaging consistency in standard room illuminations, a time value was estimated for each image.

1. N. Tabiryan, S. Serak, X.-M. Dai and T. Bunning, *Optics Express*, 2005, **13**, 7442-7448.
2. Y. Yu, M. Nakano and T. Ikeda, *Nature*, 2003, **425**, 145.