Supporting Information

Shear-induced alignment of low-aspect-ratio nanorods for modulations of multiple optical properties

Zhijie Chen,[a] Hai Li,[a] Chaoran Li,*[a] Jingjing Liu,[b] Wenqiang Hua,[c] Xiaojie Zhang,[d] Chengcheng Zhang,[a] Mengqi Xiao,[a] Ao-Bo Xu,[a] Le He,*[a] and Xiaohong Zhang*[a]

[a]Institute of Functional Nano & Soft Materials (FUNSOM), Jiangsu Key Laboratory for Carbon-Based Functional Materials & Devices, Soochow University, 199 Ren'ai Road, Suzhou, 215123, Jiangsu, PR China.

E-mail: lehe@suda.edu.cn; crli@suda.edu.cn; xiaohong_zhang@suda.edu.cn

[b]Institute of Information Technology, Suzhou Institute of Trade and Commerce, Suzhou, 215009, Jiangsu, PR China.

[c]Shanghai Synchrotron Radiation Facility, Shanghai Advanced Research Institute, Chinese Academy of Sciences, Shanghai 201204, PR China

[d]Department of Experimental Center, Medical College, Soochow University, Suzhou, 215123, Jiangsu, PR China

Supporting Information

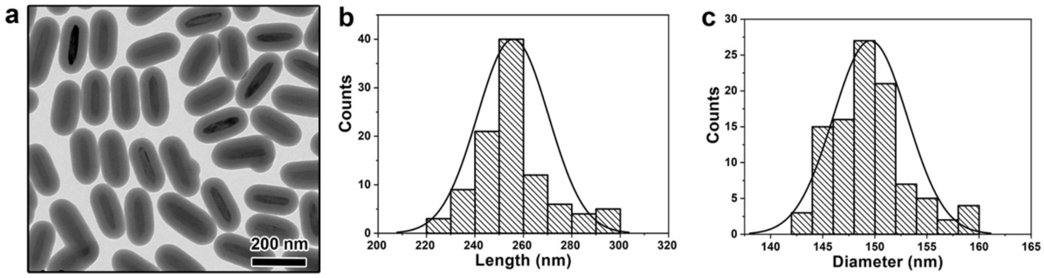

Fig. S1 (a) TEM image of silica nanorods prepared from the FeOOH template. (b-c) Average length and diameter obtained by measuring 100 particles.

Supporting Information

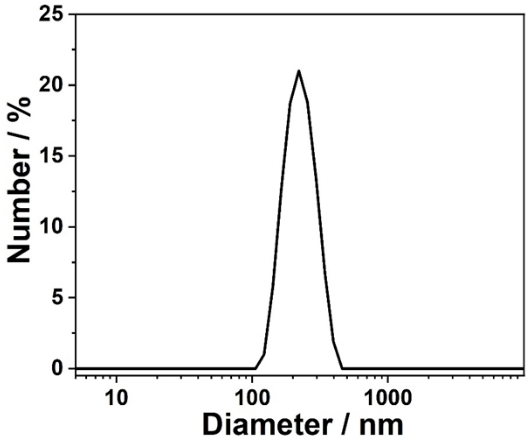

Fig. S2 DLS curve of the nanorod building blocks.

Supporting Information

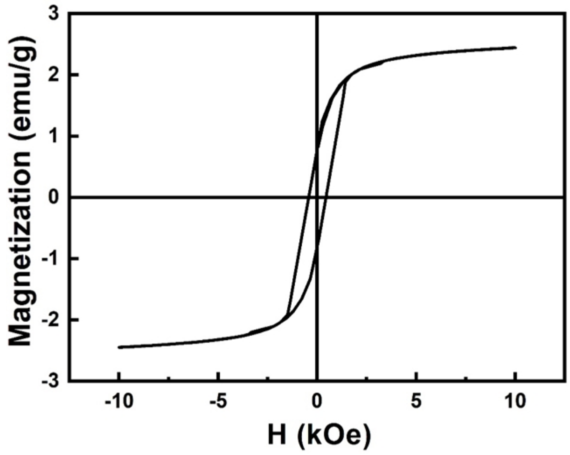

Fig. S3 The room-temperature magnetization curve of the Fe_3O_4@SiO_2 nanorods revealed their ferromagnetic nature, with a saturated magnetization of 2.43 emu/g, a remanence of 0.82 emu/g, and a coercivity of 0.45 kOe.

Supporting Information

Fig. S4 Digital image of the microfluidic chip used in the experiment.

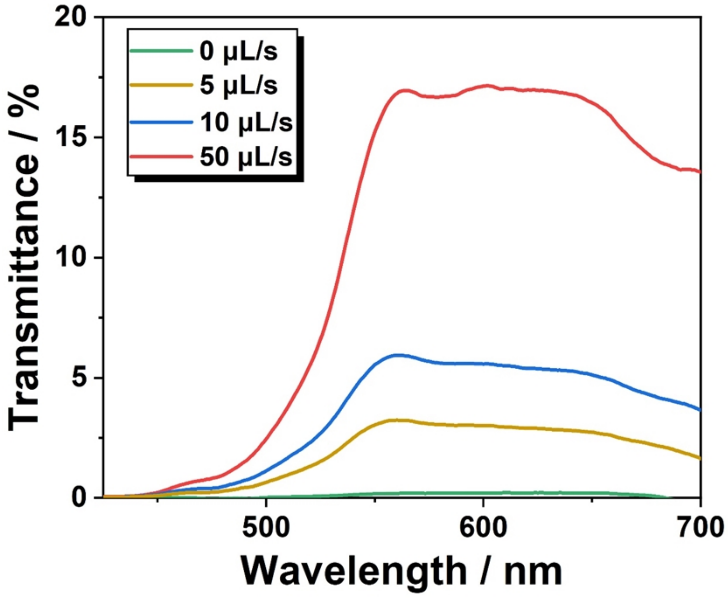

Fig. S5 The transmitted spectrum of the nanorod CCA (volume fraction = 30%) flowing through the microfluidic chip with different rates.

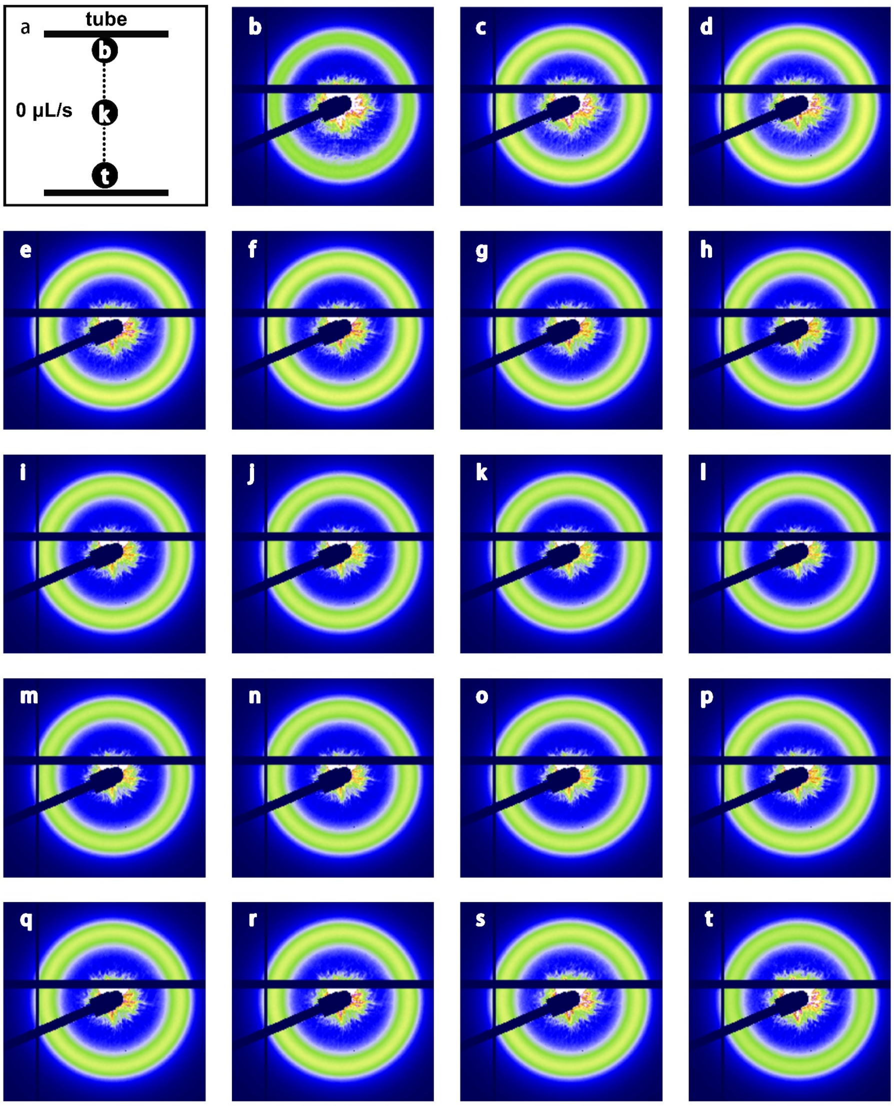

Fig. S6 (a) Schematic illustration of the side view of the tube. The black dots indicate different measured positions. (b-t) USAXS patterns of the nanorod CCA (volume fraction = 30%) in the stationary state measured from different positions.

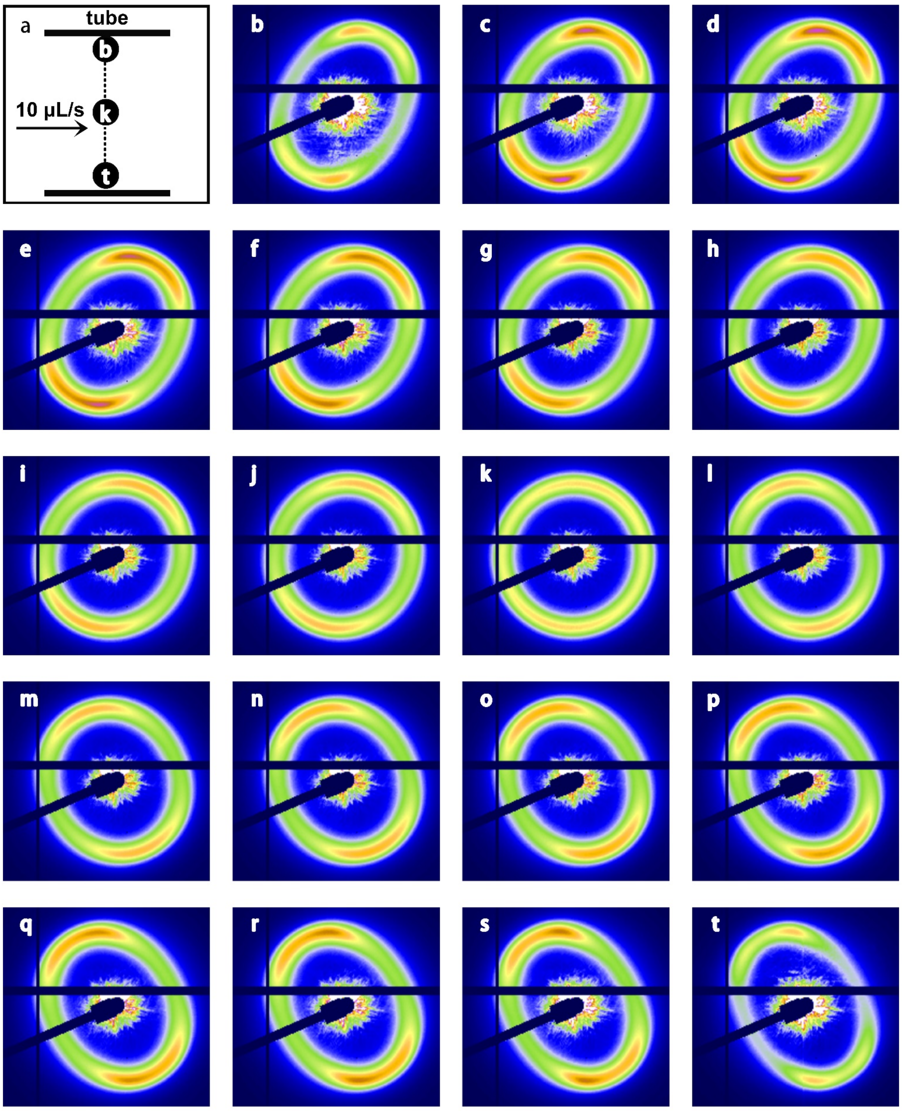

Fig. S7 USAXS patterns of the nanorod CCA (volume fraction = 30%) at the flow rate of 10 μL/s measured from different positions.

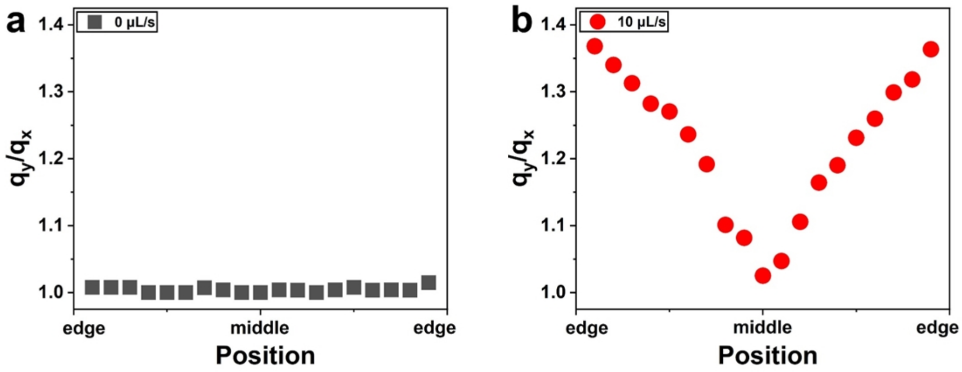

Fig. S8 Values of q_y/q_x at different positions for the nanorod CCA (volume fraction = 30%) at different states.

Supporting Information

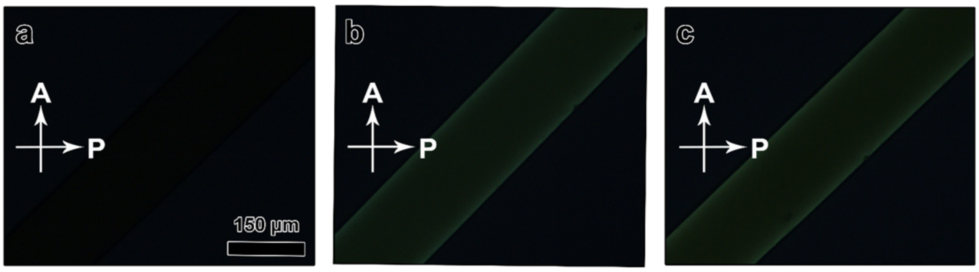

Fig. S9 POM images of the silica nanorod suspension with the 5% volume fraction flowing through a microfluidic chip with different rates: (a) 0 µL/s, (b) 10 µL/s and (c) 40 µL/s.

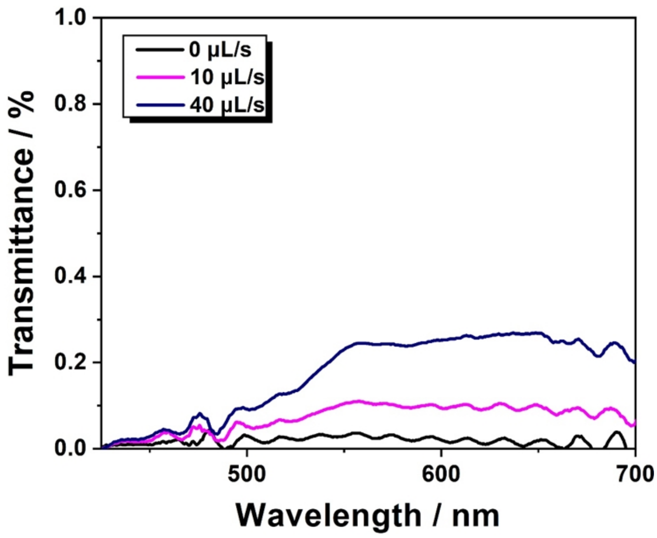

Fig. S10 Transmittance spectra of the silica nanorod suspension (volume fraction = 5%) flowing through the microfluidic channel at different rates.

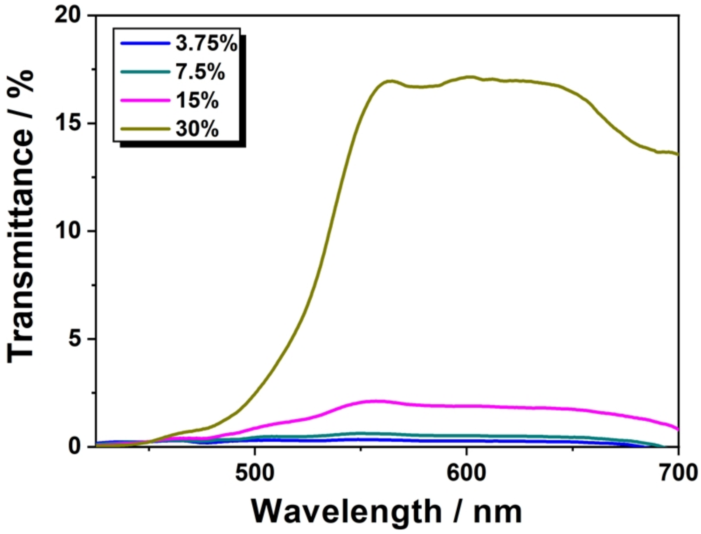

Fig. S11 Transmittance spectra of different silica nanorod suspensions flowing through the microfluidic channel at the rate of 50 μL/s.

Supporting Information

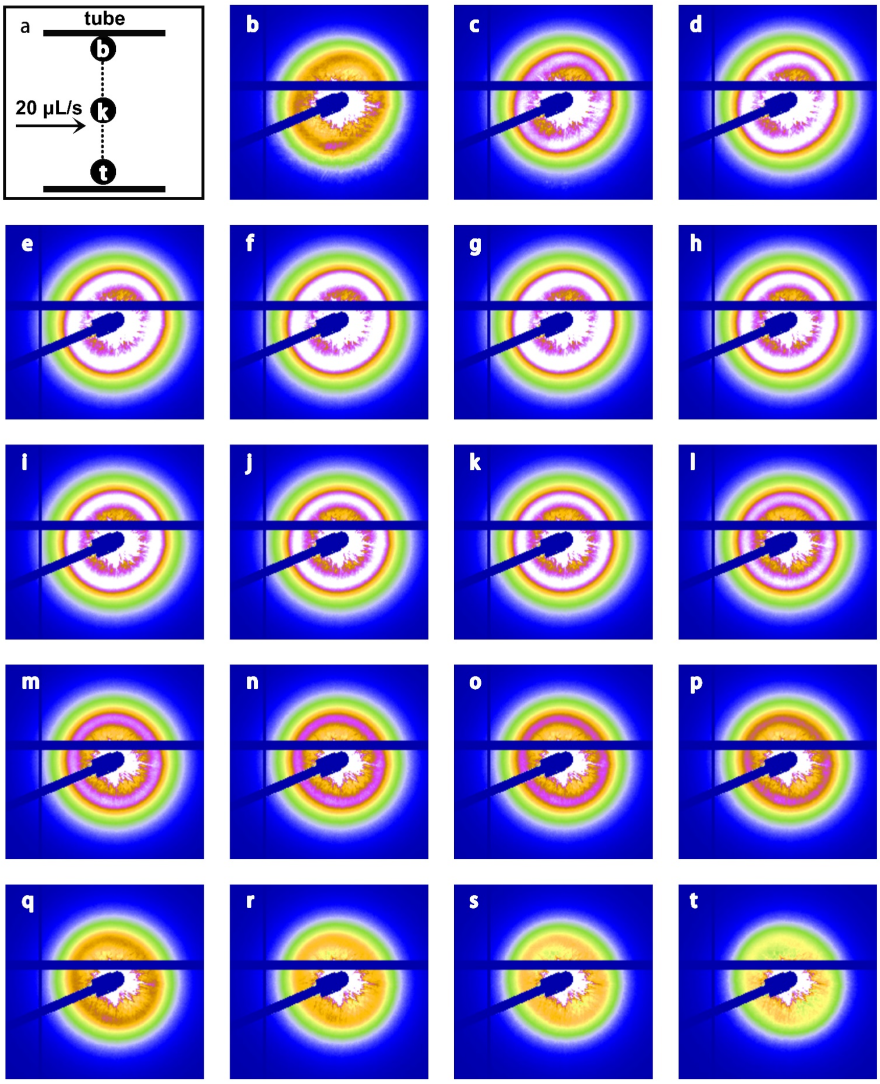

Fig. S12 USAXS patterns of the silica nanorod suspension (volume fraction = 5%) at a 20 μL/s flow rate measured from different positions.

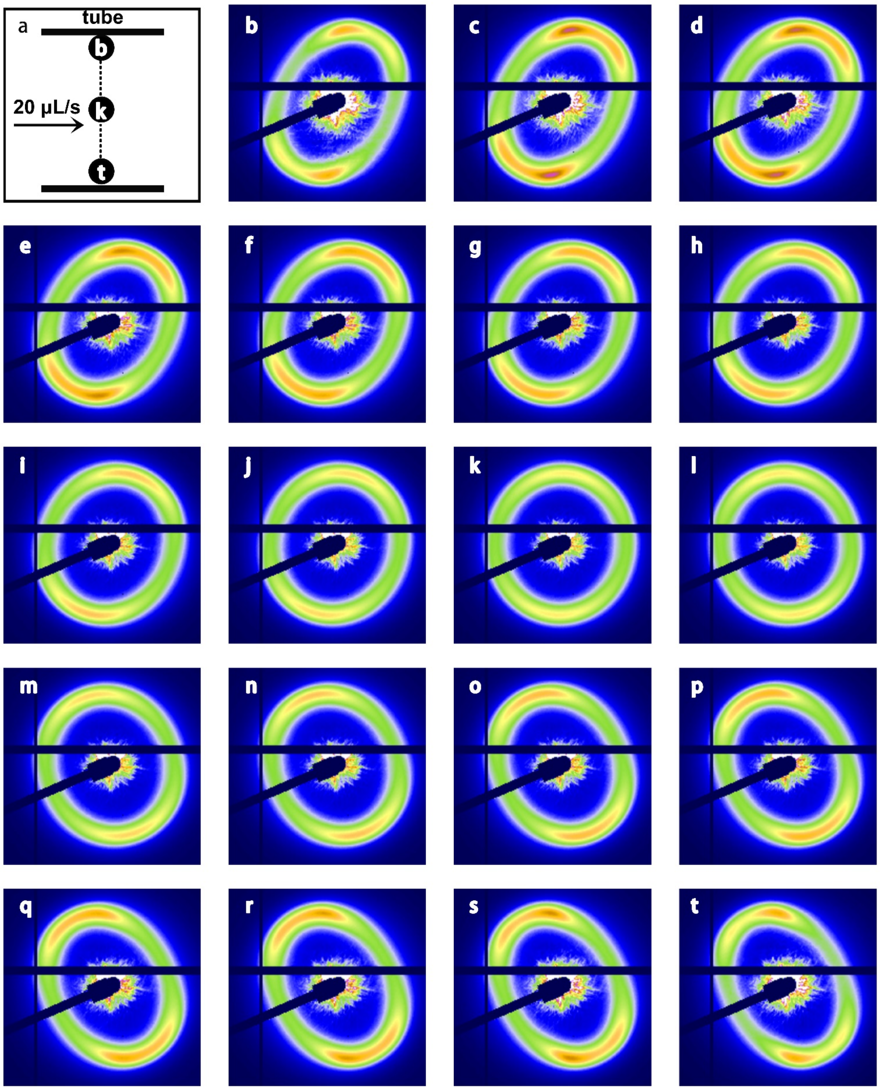

Fig. S13 USAXS patterns of the nanorod CCA (volume fraction = 30%) at a 20 μL/s flow rate measured from different positions.

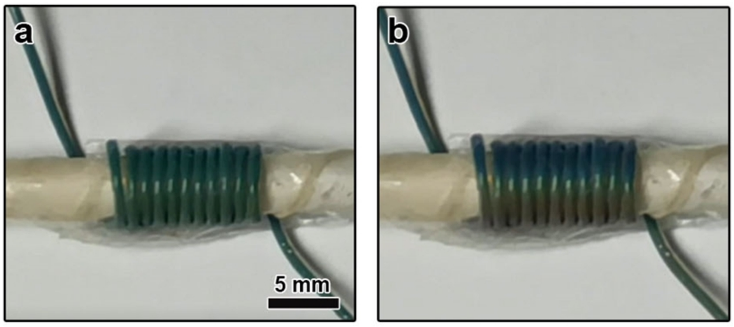

Fig. S14 Digital photos of the structural color of the nanorod suspension (volume fraction = 20%) (a) in the stationary state and (b) with a 10 μL/s flow rate.

Fig. S15 Schematic diagram of the moving process of the nanorods in the film caused by the liquid flow generated from the deformation.

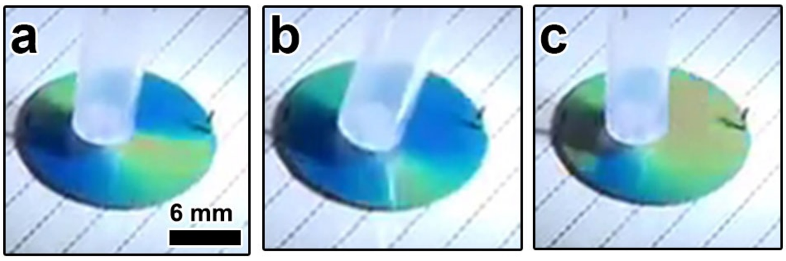

Fig. S16 Digital photos of different patterns caused by pressing down on the device constructed with the nanorod CCA (volume fraction = 20%).

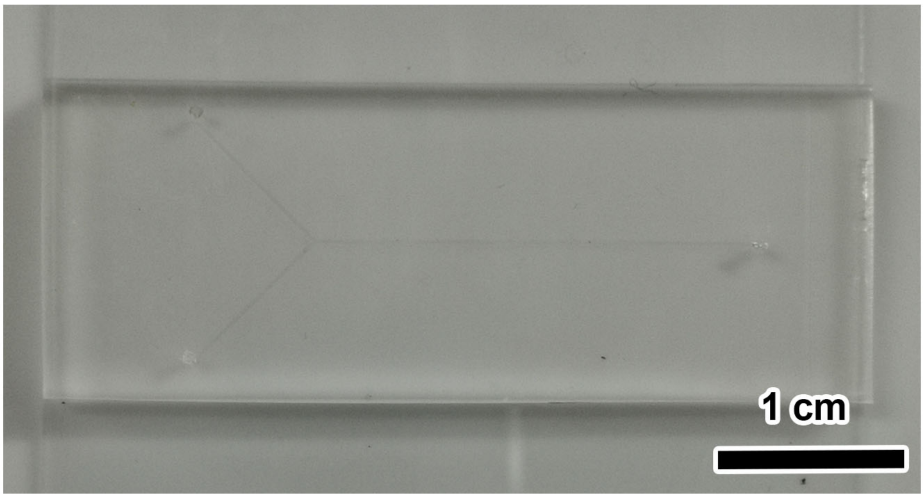

Fig. S17 Digital photo of the microfluidic chip used in the experiment. The suspension was flowing from the right entrance to the left branched exit. The exit was blocked or circulated.

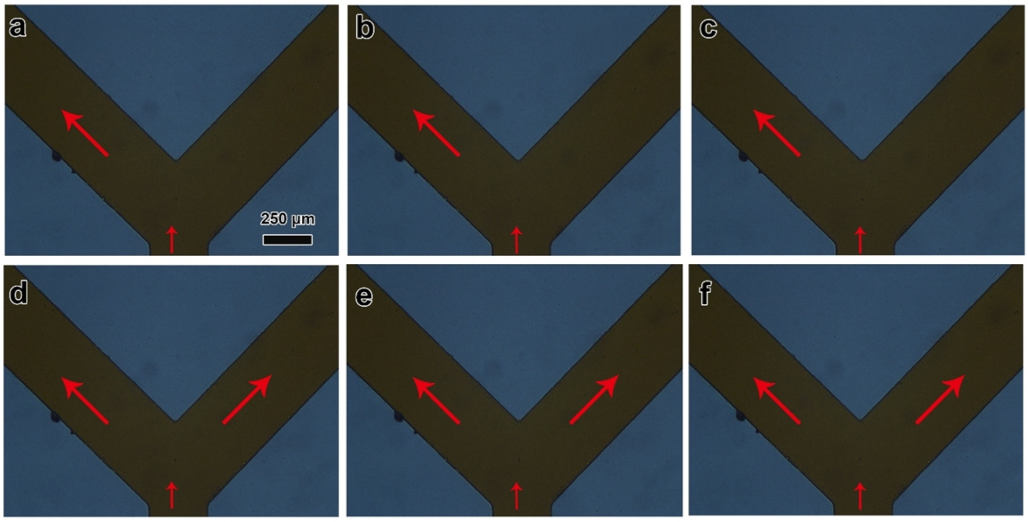

Fig. S18 Optical microscopy images of the nanorod CCA (volume fraction = 20%) encapsulated inside a Y-shaped microfluidic channel at different flow rates: 0 μL/s for (a) and (d), 10 μL/s for (b) and (e), 30 μL/s for (c) and (f). The right exit of the channel was intentionally blocked in (a-c).

Supporting Information

Supplementary Video

Video S1 Video of the nanorod CCA (volume fraction = 20%) shaken on the mechanical vibrator showing flow-induced structural color change.

Video S2 Video of the nanorod CCA (volume fraction = 20%) flowing through the pipeline with different flow rates showing flow-induced structural color change.

Video S3 Video of the nanorod CCA (volume fraction = 20%) pressed by the external force showing flow-induced structural color change.