Electronic Supplementary Information (ESI)

Unique orientation of 1D and 2D nanoparticle arrays confined in smectic topological defects

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Ellipsometry measurements

The full polarimetric properties of large stripes have been measured using a multimodal imaging Mueller polarimetric microscope.[1] The observation of the large stripe period allowed to estimate the LC thickness to be approximately 180 nm.[2] Fig.SI 1.a displays the experimental 4×4 Mueller matrix measured on the large stripes. All elements were normalized to the first one which is not displayed. The values were clipped to [-0.4;0.4] to enhance the visibility of small values. Fig.SI 1b displays a Mueller matrix calculated using the model shown on Fig.SI 1c which accounts for the expected structure of the large stripes (see Fig. 1d). This model has been defined with the assumption that the LC film can be divided into several domains of constant optical axes.[2,3] The decomposition in sub-domains shown on Fig.SI 1c is similar to the one of the oily streak structure. The two top layers, labelled RGB bottom and top account for the two quarters of cylinders at the border of a given hemicylinder as well as for the central part between the two quarters of cylinder. The bottom layer, referred to Fig.SI 1c as transition area, contains a fraction of parallel layers directly in contact with the substrate, *a priori* in the center of the stripes in contrast with the usual model of oily streaks.[2,3] The ordinary and extraordinary optical constants of 8CB were set to 1.52 and 1.67, respectively. We used the optical constants of BK7 for the glass substrate. There are three possible parameters that might be adjusted : the total thickness of the large stripes, the thickness of the transition area and the fraction of horizontal layers in the transition area. These parameters are strongly coupled and adjusting them independently would yield large uncertainties on the values. In our case the total thickness was set at 180 nm and this parameter was not adjusted. Only the thickness of the transition area and the fraction of parallel layers in the transition area were adjusted. The total thickness was left constant by modifying the top RGB thickness according to the thickness of the transition area. The best adjustment was obtained for a thickness of the transition area of 34 nm (± 7 nm) and a percentage of flat layers directly in contact with the substrate of 16% (±7.5%). The relatively large error bars of the values are partly related to the correlation between these two parameters. The agreement between the experimental Mueller matrix and the calculated one, respectively shown on Fig.SI 1a and 1b, and the significant value found for the fraction of parallel layers in the model suggests that the assumption of a central part containing flat smectic layers directly on the substrate is reasonable.

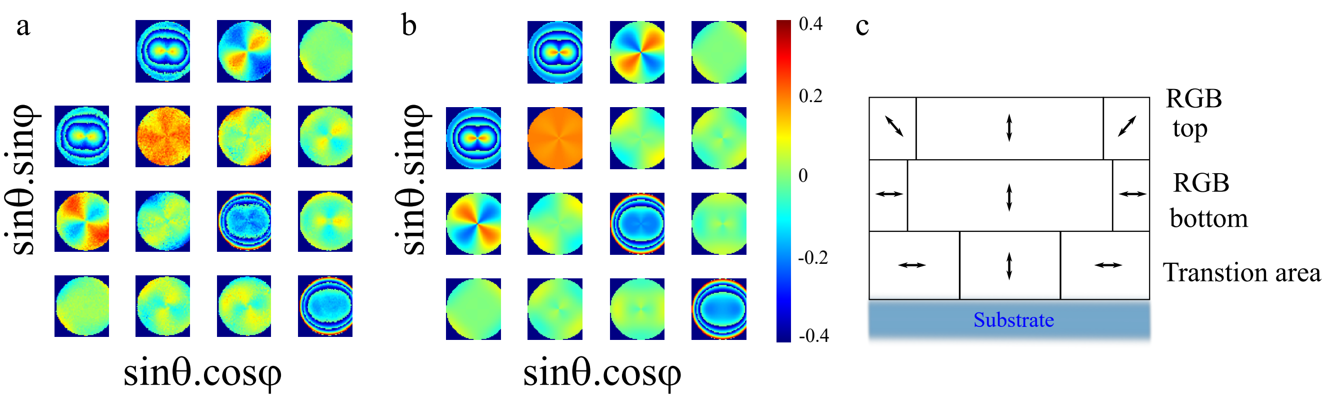
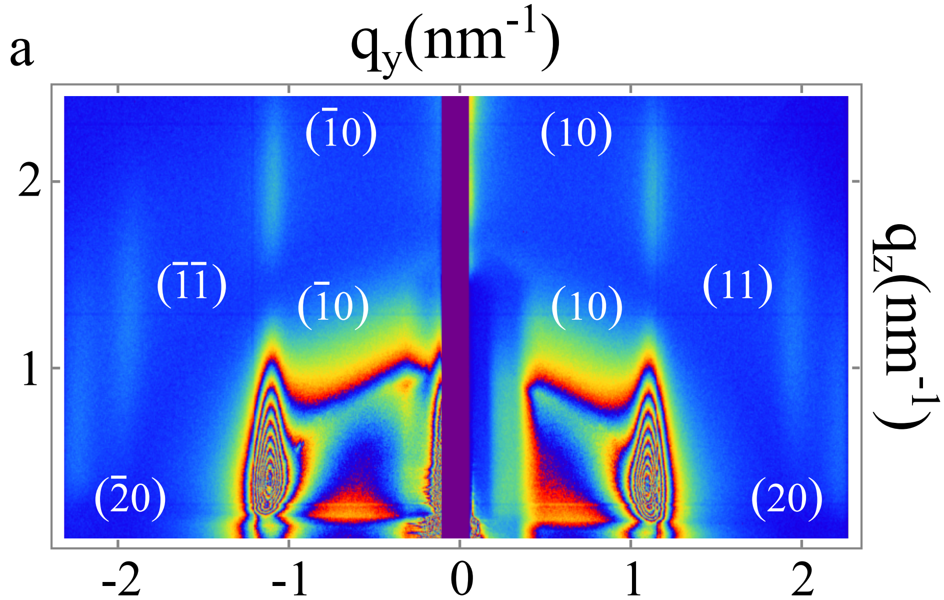


Fig.SI 1 (a) Measured and (b) calculated Mueller matrix elements for a 8CB film of 180 nm average thickness, containing large stripes (as mapped by the objective ($x = sin\theta.cos\phi, y = sin\theta.sin\phi$)). (c) The corresponding simplified model of the LC hemicylinders shown in side view with domains of constant optic axes directions indicated by the double arrows.



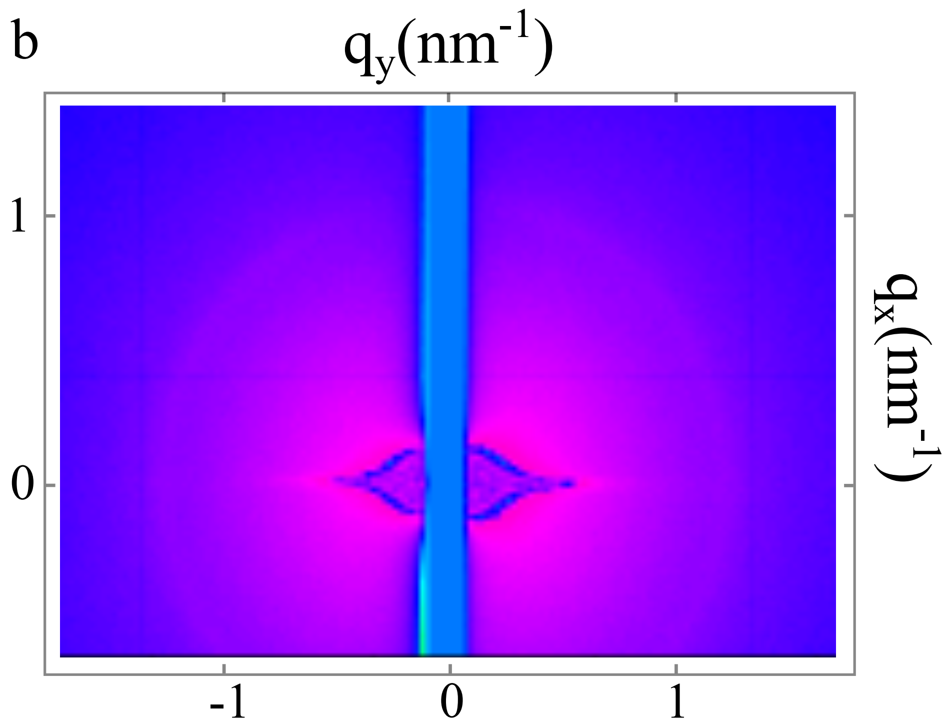


Fig.SI 2 X-ray scattering patterns of GNPs deposited on PVA substrate without LC: (a) GISAXS pattern, where the X-ray beam is parallel to the substrate (incident angle 0.25^o). The various scattering rods correspond to the signal of hexagonal NPs assemblies. (b) TSAXS pattern of the same area observed in transmission (the X-ray beam is perpendicular to the substrate). The ring corresponds to the ((10), ($\bar{1}$0)) scattering rods in (a) (GISAXS), demonstrating the different possible orientations of the hexagonal GNPs assembly.

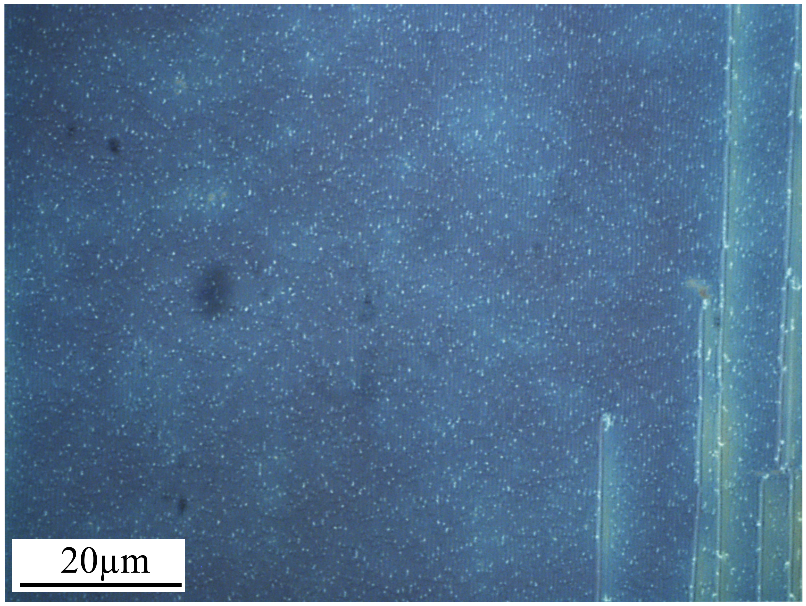


Fig.SI 3 POM picture with parallel polarizers of a 8CB film with low concentration ($e_{avg} = 120$ nm and GNP concentration $C_{avg} = 1700$ GNPs µm^{-2}). Only small ribbons are observed, suggesting that the area is mostly covered by GNP chains confined in the 1D defects[4].

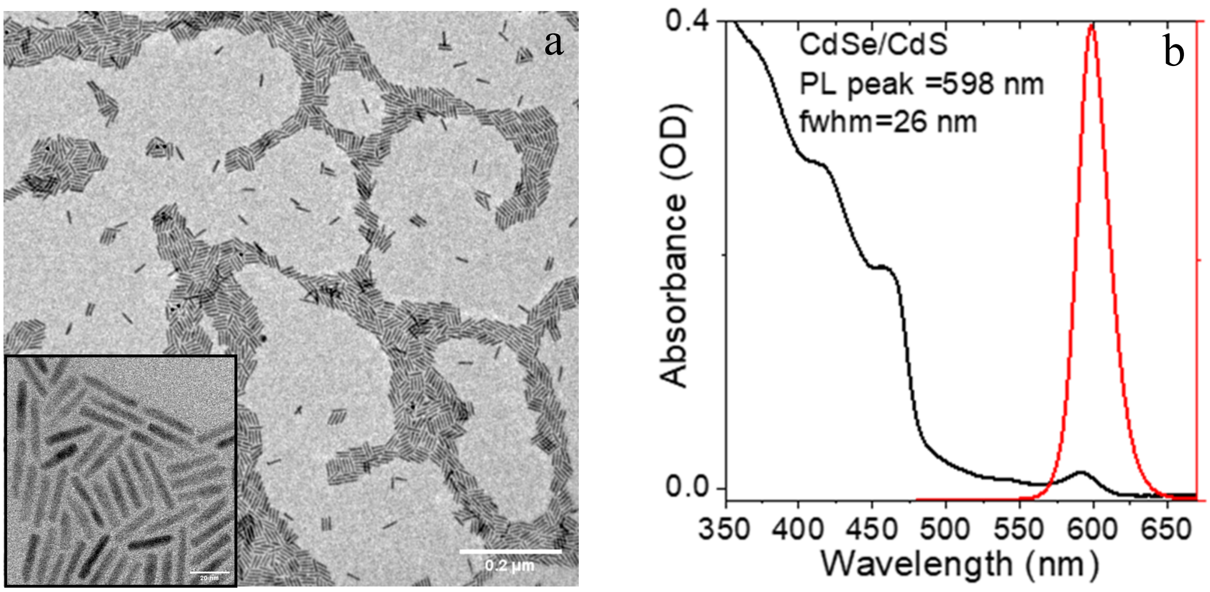


Fig.SI 4 (a) Transmission Electron Microscopy (TEM) of CdSe/CdS dot-in-rods (diameter 7 nm and length 22 nm) drop casted directly on a copper TEM grid, using a JEOL 2010 microscope operated at 200 kV. (b) The corresponding absorption and photoluminescence (PL) spectrum with a PL peak at 598 nm.

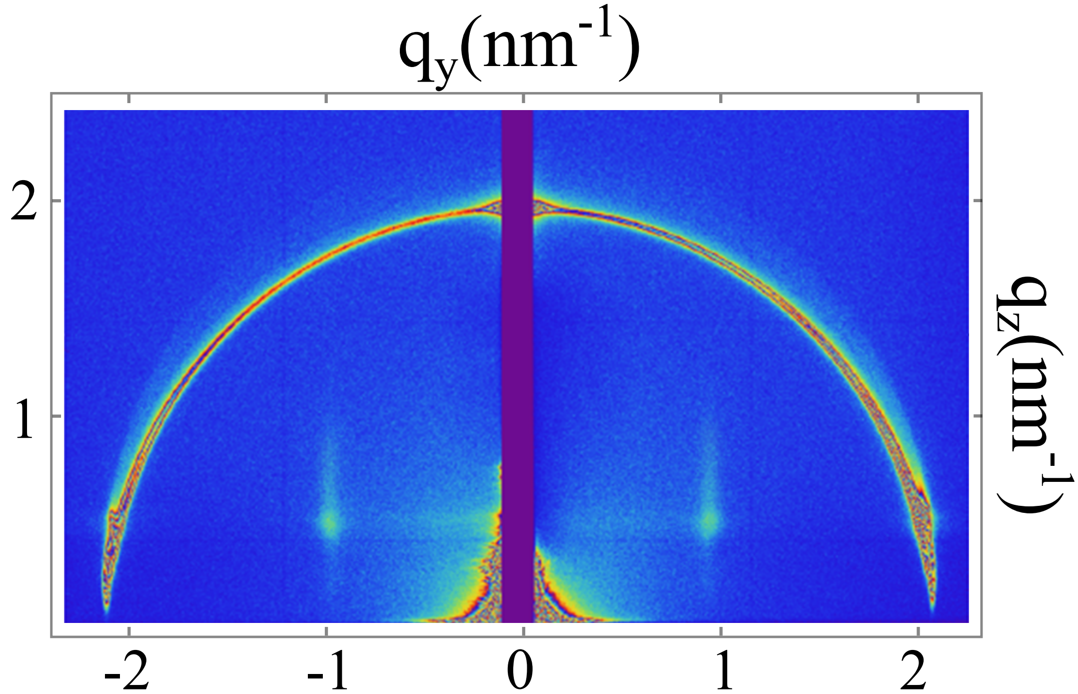


Fig.SI 5 GISAXS scattering pattern of DRs composite sample zone dominated by oily streaks ($e = 170$ nm, $C_{avg} = 980$ DRs μm^{-2}), where the X-ray beam is parallel to the substrate (incident angle 0.25^{o}). The half-circle corresponds to the LC smectic layers and the scattering rods at $q_y = \pm 0.9$ nm^{-1} are in agreement with a side-by-side packing of DRs in oily streaks with a center-to-cente distance of 8.06 nm between DRs.

References

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