ESRF	**Experiment title:** Structure ormation in colloidal hematite/cellulose mixtures in direct and reciprocal space	**Experiment number**: SC 4036
Beamline: ID-11	**Date of experiment**: from: 13/05/2015 to: 18/05/2015	**Date of report**: 26/2/2016
Shifts: 18	**Local contact(s)**: Dr. Gavin Vaughan	*Received at ESRF:*

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Report:

The objective of the proposed experiment was to investigate the crystallisation of colloidal cubes in the presence of cellulose nanowhiskers as depletant. The cellulose nanowhiskers are highly anisometric particles and little is known about how this affects the depletion interaction between the larger colloidal cubes. We were granted 18 shifts to measure small angle diffraction patterns as well as attempt to measure x-ray microscopy images in direct space.

Due to the high energy beam used at ID-11, the cellulose nanowhiskers showed only very minor scattering contrast. The silica colloidal cubes did show diffraction and the diffraction patterns of colloidal crystals in the presence and absence of cellulose nanowhiskers were recorded. Fig. 1 shows a typical diffraction pattern in the absence (a) and presence (b) of cellulose nanowhiskers. Depending on the height within the sample, hexagonal rotator phases or rhombic phases (sometimes with twinning defects) were observed.

The same phases were observed in the presence and in the absence of cellulose nanowhiskers: the depletant did not cause the formation of structures different than those already observed in their absence. Careful quantitative analysis of the data (which has not been done yet) should point out what the effect of the presence of the depletant has been.

Due to unforeseen circumstances, Anatoly Snigirev, who was meant to be the principal experimentalist for the x-ray microscopy part of the experiment, was not able to join for this experiment.
In x-ray microscopy mode, single exposures did not show sufficient contrast to discern the real space features in the samples. However, by recording 10 or 20 exposures of the same site within a sample and adding the exposures, a real space image of the crystal structure could be observed. Fig. 2 shows one of the results.

We would like to thank Gavin Vaughan for his support during this experiment.

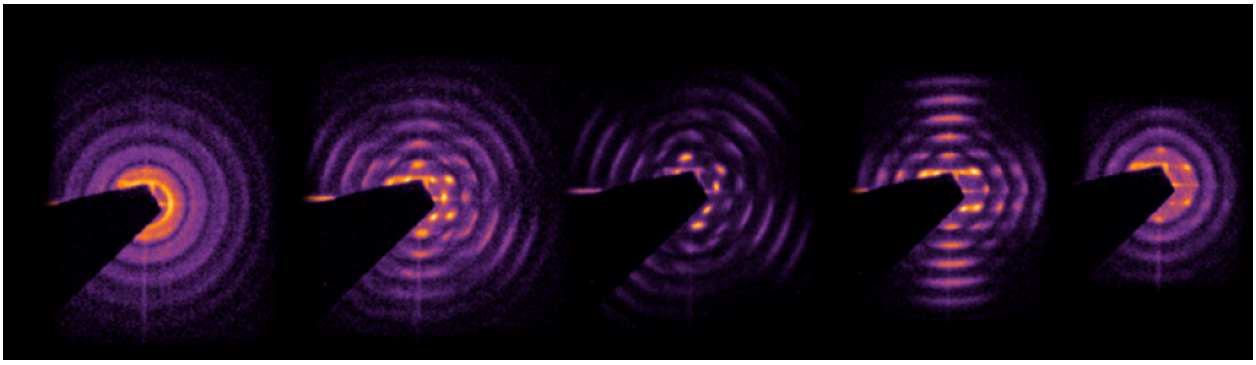

Figure 1. Set of small angle diffraction patterns recorded in a colloidal crystal of silica cubes in the presence of cellulose nanowhiskers. Left corresponds to the bottom of the sediment to right the top of the sediment. The sediment shows a bottom part which is isotropic, followed by a rhombic crystal (middle three patterns) with no, one or more twinning defects, and finally the top sediment shows a hexagonal rotator phase.

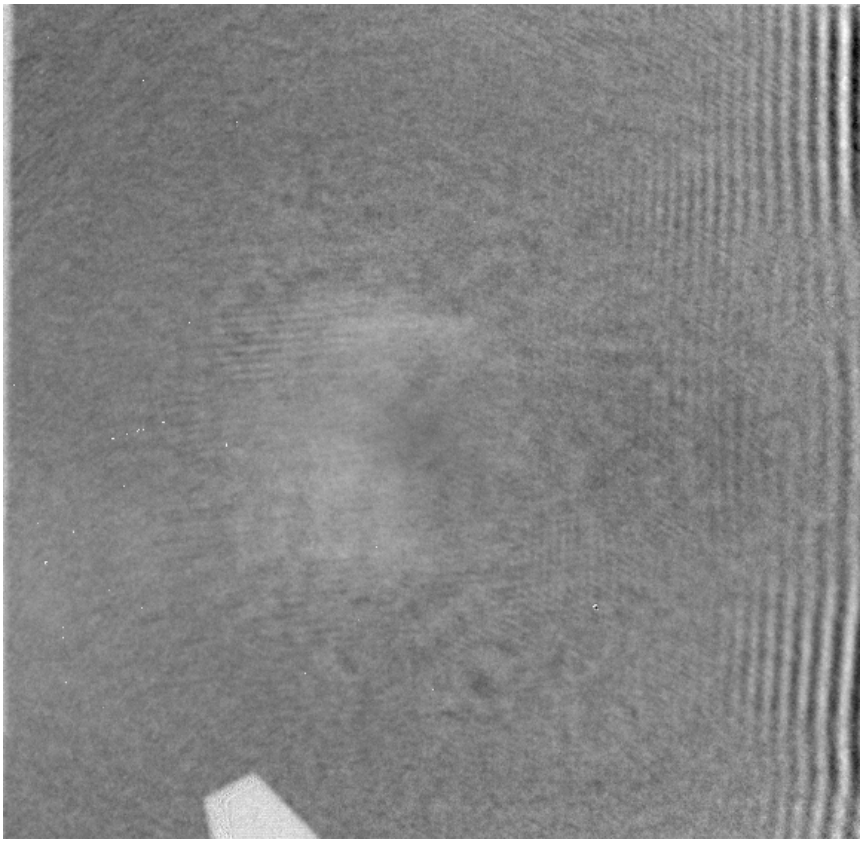

Figure 2. Set of 10 microscopy images of silica colloidal cubes after background subtraction. In the centre of the image, the set of crystal planes are visible.