ESRF	**Experiment title:** Shear band formation in a drying colloidal film	**Experiment number**: SC-4415
Beamline: ID13	**Date of experiment**: from: 9th Dec 2016 to: 11th Dec 2016	**Date of report**:
Shifts: 6	**Local contact(s)**: Manfred Burghammer, Andreas Johannson	*Received at ESRF:*

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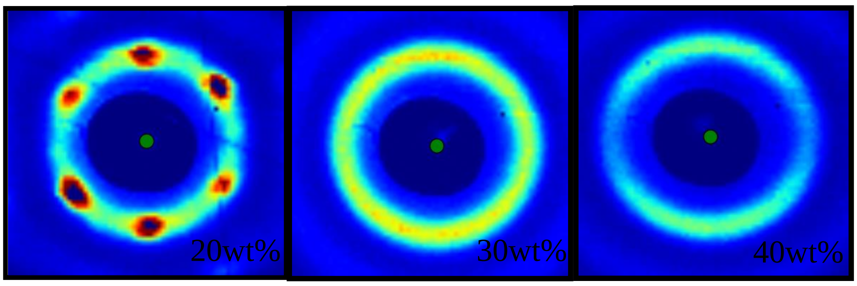
Report: This represents a preliminary report.

The main aims of our proposal were to investigate the use of microfocus SAXS to map the in-situ and spatially resolved drying dynamics of a colloidal fluid as it forms a film due to evaporation. We aimed to measure a) differences in local structure that occur during drying and b) to investigate the build up and release of the local strain in a drying film.

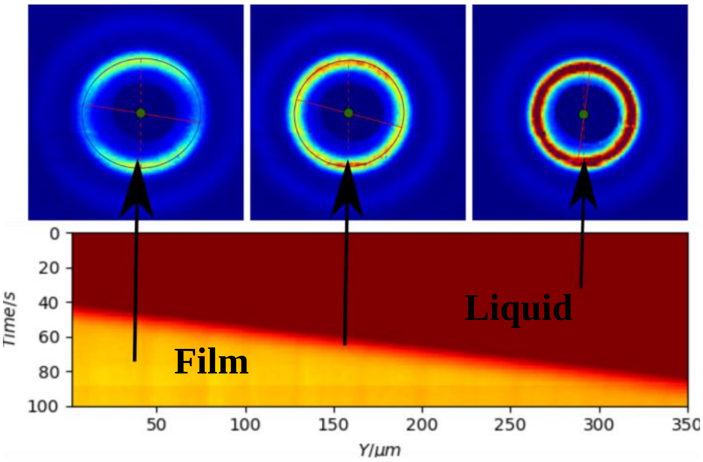
Our key results are summarised below:

1) The concentration of particle solution effects the speed with which the film is formed. This appears to have a critical role in the packing of particles in the film. At high concentrations (40wt%, 30wt%) near to the compaction front we observed amorphous packing of particles. These films displayed prominent shear bands. At the lower concentration of 20wt%, crystalline features appeared in the scattering patterns and the films displayed no shear bands. It is an interesting open question as to whether the crystallinity suppresses shear band formation?



2) It is widely believed that at the boundary between liquid and film, particles form an initial crystal which collapses under stress leading to aggregation and an amorphous film [1]. Our results show that there is a more complicated picture at work. Firstly, higher concentrations do not crystallize, and secondly at low concentrations these crystals persist into the film indicating that the collapse does not occur universally.

3) A key aim of our proposal was to investigate whether the microfocus SAXS could be used to measure spatially varying strains. Fitting an ellipse to the measured scattering pattern enables us to extract the deviatoric strain $\varepsilon=(2/3)(q_z/q_y-1)$ [2] at each point on the sample (See figure 2). Figure 2 illustrates this for a sample in which a line was scanned repeatedly. Initially the scattering patterns are isotropic but as the film develops the scattering patterns become more elliptical indicating a build up of strain.



References

[1] L. Goehring et al Langmuir 26, 9269 (2010)
[2] F. Boulogne et al. arXiv:1309.1048v2 (2014)