ESRF	**Experiment title:** Structure and long-range order of a porphyrin template on KAP	**Experiment number**: SI1675
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Report:

Structure determination of proteins is predominantly achieved using X-ray crystallography. The main bottleneck in this process is the growth of protein crystals of sufficient size and quality, and finding methods to improve the growth is an important research area. One method we are investigating is the use of supramolecular templates as a means to grow both 3D and 2D protein crystals. Membrane proteins are notoriously hard to crystallise, and templates are an interesting route to provide a long-range ordering field in which high-quality 2D crystals can be grown.

As a first step in this project, we need to make highly-ordered templates, i.e., with large domains and small mosaic spread. The system we have chosen is porphyrin molecules on Potassium Acid Phthalate (KAP) substrates with (010) orientation. We have first studied this system using AFM, growing the porphyrin layers from a heptane solution. Based on this we expect a monolayer of porphyrin to adhere at the surface at undersaturation conditions. For sufficiently high supersaturation, epitaxial needles are formed, which orientation depends on that of the monolayer.

We designed and built a special in situ cell made from PMMA for the experiments in order to work under clean conditions. The surface of KAP was first measured without solution, but this gave too much radiation damage. Therefore the substrate was directly put in heptane from that point on. In this way it was possible to measure the specular rod and the (20), (11) and (12) and their symmetry equivalents, before the radiation damage exceeded 10% (measured as drop in total intensity of a surface sensitive reflection). These rods were measured for the

substrate in pure heptane, and in porphyrin solutions of respectively 10^{-3}M, 10^{-4}M, 10^{-5}M. In the specular ridge scan a small difference was found between these concentrations and the pure heptane, the intensity seemed to go down a little compared with that of the sample with pure heptane. To get more insight in the drying process, a highly concentrated solution was allowed to evaporate during ridge scan measurements. Indeed the ridge scan changed during drying. It showed two peaks between 0 and 1 of the specular (Figure 1). It was investigated how the profile evolved in time, however, when it was clear that the surface was again getting rougher, the drying was stopped and a dataset was taken.

A more extensive data analysis needs to be carried out, but this experiment has shown that the porphyrin layer will be difficult to detect under the present conditions.

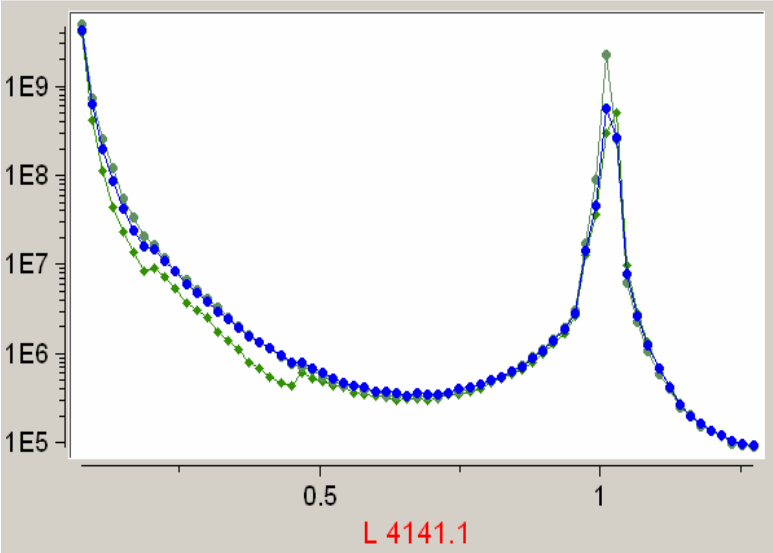

Figure 1:ridge scan of drying of the sample, the light green shows the change and the blue shows that this effect is almost gone after some more scans