



	Experiment title: Cation competition at the muscovite mica mineral surface	Experiment number: HC-3815
Beamline: ID03	Date of experiment: from: 14-11-18 to: 20-11-18	Date of report: 03-06-2019
Shifts: 18	Local contact(s): Linus Pithan	<i>Received at ESRF:</i>
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Report:

Only few techniques are capable of determining mineral surface structures if multiple ionic species are present in solution. We have studied the competition of Cs⁺ and K⁺ cations at the muscovite mica-electrolyte interface by surface X-ray diffraction (SXRD) experiments. Using SXRD the full interfacial structure can be determined, including the percentages of adsorbed monovalent and divalent cations. This allows us to investigate the effect of hydration energy on the cation competition, since Cs⁺ is less hydrated than K⁺, whereas the valency is the same.

In total, 11 data sets regarding cation competition were successfully measured for muscovite mica in contact with a solution containing Cs⁺, K⁺ or a combination of both cations. Experiments were performed with a total salt concentration of 25 mM and 475 mM. We measured several relative K⁺/Cs⁺ ratios (i.e. 0%, 25%, 50%, 75%, 100% Cs⁺) for both salt concentrations. For each data set several unique unique crystal truncations rods were measured, such as the (00), (11) and (20) rods.

Data analysis is in progress and will take time due to the large number of data sets investigated, but preliminary results show that the competition between K⁺ and Cs⁺ cations can clearly be observed. A publication is expected to follow from this work.

During this successful run, additional experiments were performed. In this case, we have investigated the adsorption structure of organothiols on muscovite mica. The measured data has been fully analysed, see Fig. 1. We found that the organothiols form a stable monolayer on both K^+ and Cu^{2+} mica. These monolayers have a well-defined thickness, which influences the SXR data, but they do not possess any lateral ordering. These results have been submitted for publication.

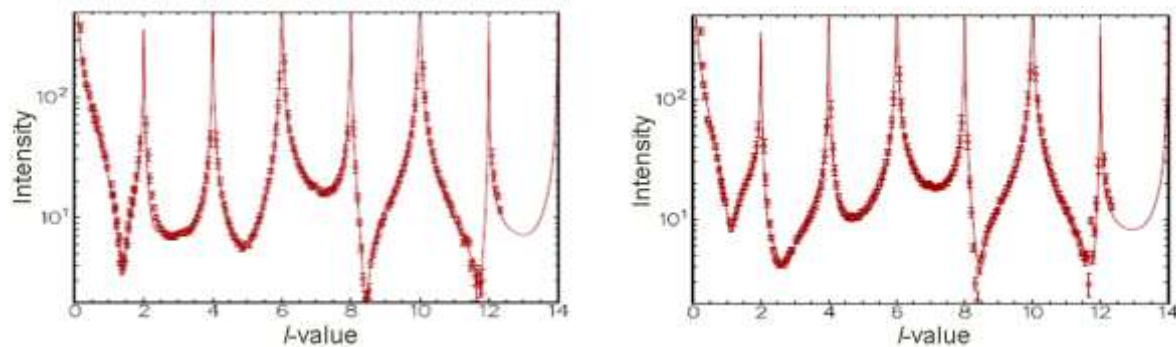


Figure 1: SXR specular data of 11-mercapto-1-undecanol on K-terminated (left), and Cu-terminated (right) muscovite mica (dots), and fit (line). The y-axis depicts the structure factor amplitude and the x-axis depicts the l -value.