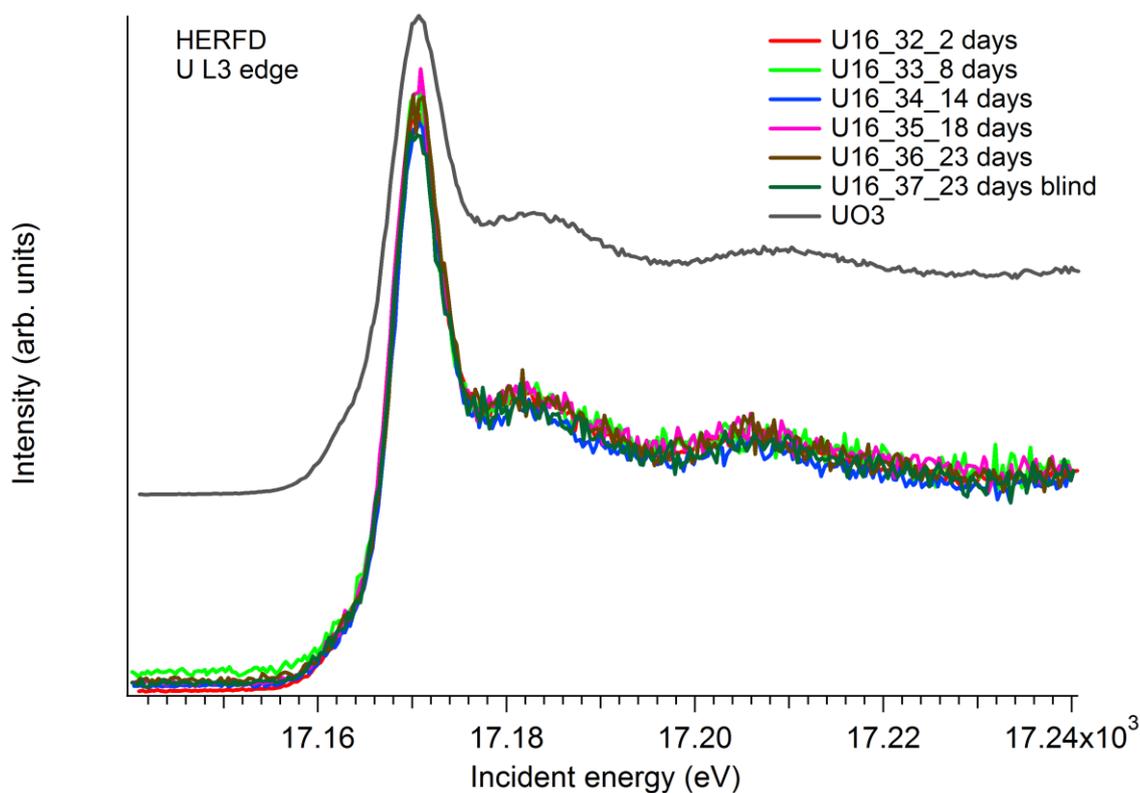


  ROBL-CRG	<b>Experiment title:</b> Uranium sorption on bacteria by high energy resolution X-ray absorption	<b>Experiment number:</b> 20-01-779
<b>Beamline:</b> BM 20	<b>Date of experiment:</b> from: 28.09.16                      to:05.10.16	<b>Date of report:</b> 12.4.2017
<b>Shifts:</b>	<b>Local contact(s):</b> Kristina Kvashnina	<i>Received at ROBL:</i>
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## Report:

The aim of the studies was to obtain information about the electronic structure and valence state of uranium species formed by the bacteria with a help of high energy resolution fluorescence detection (HERFD) method at the U L<sub>3</sub>-edge. The knowledge about the nature and strength of the formed uranium-bacteria-species is of great importance for the understanding of mobilization or immobilization of uranium under the conditions of a nuclear repository. For HERFD studies biofilm samples from Äspö HRL (Sweden) were used where *Gallionella ferruginea* is associated with bacteriogenic iron oxides (BIOS). *Gallionella ferruginea* is known as a gram-negative, stalk-forming bacterium. It requires Fe(II) as an electron donor and oxygen as an electron acceptor to yield cellular energy and growth at circumneutral pH. The stalk represents an organic

surface upon which Fe oxyhydroxides can precipitate. In kinetic U sorption studies samples were prepared with an initial U concentration of 100  $\mu\text{M}$  under anaerobic conditions. The results showed a fast immobilization of uranium and a decrease of  $E_h$  to  $226 \pm 30$  mV during 23 days.



**Figure 1.** HERFD spectra at the U L<sub>3</sub> edge of uranium sorption samples on bacteriogenic iron oxides, compared to UO<sub>3</sub> reference sample.

Figure 1 shows that in every sample the  $\gamma$ -shoulder is fully expressed at about 17.185 keV. Additionally, the pre-edge structure feature at 17.165 keV, characteristic for the U(VI) compounds and directly related to the 2p-5f quadrupole transitions, is clearly observed for UO<sub>3</sub> reference sample and for the studied materials. That means, that there is no indication for a significant reduction of the oxidation state. The amount of U(IV) contribution has not been detected in any sample.