| ESRF | **Experiment title:** Microstructure of plasma sprayed hydroxyapatite coatings by high energy x-ray phase contrast tomography with $\mu$m-Resolution | **Experiment number:** LS-1268 |
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Report:

Hydroxyapatite is one of the most used biomaterials by the modern medicine as covering material for hip prothesis. Previous test experiments (exp n.LS-880) using x-ray phase contrast $\mu$-tomography showed the possibility of in depth characterization of porosity, crack formation, etc. of plasma sprayed hydroxyapatite coatings, determined during the deposition process. The aim of this experiment was to continue the analisys started during the test experiment in order to compare results for different specimen preparation. Furthermore we applyed the $\mu$-tomography to image small fragments of biological tissues.
A primary radiation originated from a high-beta ondulator yielding a beam of ca. $10^9$ ph/s was employed. Monochromatization of the beam was performed by means of a vertical double flat Si [111] crystal. After being monochromatized, the radiation was directed through a ionization chamber, a fast shutter, a set of limiting slits and then on the sample mounted on a rotating stage. The transmitted radiation was recorded by means of a high-resolution CCD camera consisting of a crystal scintillator, light microscope optics with variable magnification and a CCD chip. In order to obtain good phase-contrast projections the distance from sample to scintillator was set to 10 cm. Exposure time for each projection varied from 0.5 seconds to 8 seconds as a function of the sample's absorption.
A typical microtomography scan was completed after recording, in a few semi-automatic steps, the following images: 10 dark images (fast shutter closed, hutch shutters open); 20 background images;

1250 or 2500 sample's projections, each one taken with a different sample's orientation during a full rotation of $\pi$; 20 final background images.
All files, recorded in the ESRF data format, are then stored and ready for the reconstruction process. In the following we report a projection of a small intestine blood vessel (Fig.1). The sample preparation for biological tissues was challenging. The most important aspect for this kind of samples was the wet environment. Good results were acheived using sealed glass capillary containing the sample and a very small amount of water. In figure 1 are clearly visible the glass capillary walls, the coagulated blood and the vessel walls.
Experimental results were very satisfactory although, due to the huge number of recorded projections, reconstruction are still in progress. The relationship with the staff, very skilled and with great enthusiasm and dedication, was excellent.