Cateretê: The Coherent X-ray Scattering Beamline at the 4th generation synchrotron facility SIRIUS

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Cateretê, the coherent X-ray scattering beamline at the new Brazilian synchrotron 5bent-achromat source, Sirius [1] is dedicated to coherent diffraction imaging (CDI) as well as X-ray photon correlation spectroscopy (XPCS) studies. Making the most of the coherence properties of the ultra-low emittance of the Sirius accelerator, will enable to perform 3D imaging of micrometer sized specimen down to few nanometers spatial resolution.

The Cateretê beamline is equipped with an undulator source, in a low-beta straight section, and two cryo-cooled focussing mirrors creating a 41 x 36 μm^2 (FWHM at 9 keV) coherent beam at 88 m from the source. The beamline operates in the 4 to 24 keV energy range using a horizontally deflecting 4-bounce crystal monochromator (4CM). Moving the 4CM laterally by a few mm, enables to operate the beamline in pink beam mode, maintaining the beam position unchanged. The experimental station is located 88 m from the source, followed by a 28 meters vacuum chamber hosting the Medipix (3k x 3k $pixels^2$) in-vacuum detector.

The beamline, now under commissioning, will enable to perform imaging in reciprocal space, with a particular focus on *in situ* imaging as well as cryo-imaging experiments [2], [3]. To date, we measured and obtained the first three-dimensional reconstruction of a 6 microns cube zeolite crystal. XPCS studies of zeolite nucleation and growth have also been performed and will be presented.

An operando reaction cell, enabling to image catalysts under realistic catalytic conditions and a cryogenic sample environment are under development. The latter will allow 2D and tomographic data acquisition of specimens loaded in capillaries or flat substrates such as Si_3N_4 membranes. The cryo-system is based on a low-flow cryo-cooled He gas preserving the sample stability and operates in a controlled humidity atmosphere preventing ice formation.

I will describe the Cateretê beamline and present the latest results obtained using plane-wave CDI as well as XPCS.

Figure 1. Panoramic view of the Cateretê experimental hutch and the 28 meters vacuum chamber hosting the medipix 540D detector.

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