

**MS44-2-5 High-energy X-ray diffraction for physics and chemistry on beamlines P07 and P21.1 at PETRA III, DESY**

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**Abstract**

High energy X-ray diffraction and scattering based techniques play a major role in many scientific fields incl. physics, chemistry, and materials science. In particular, they enable complex in situ and operando experiments and the analysis of local (dis)order on atomic scale. The high-energy scattering and diffraction beamlines P07-DESY and P21.1 are operated jointly with a focus on exploiting the capabilities of high energy X-rays for a wide spectrum of scientific applications.

High photon energies of 50-100 keV allow for measuring with complex sample environment while maintaining the possibility to access a wide q-range. This makes it possible to perform diffraction and total scattering experiments in a variety of conditions such as temperatures, magnetic or electric field, and other in situ and operando modes for numerous types of materials.

The beamline P21.1 is a multipurpose versatile high energy X-ray diffraction beamline. Standard experiments include studies of single crystals, amorphous materials, liquids and nanocrystalline matter at various conditions. Several sample environments are available at the beamline such as a displacive cryostat with temperatures down to 10 K, heaters for flat samples and capillaries up to 800 °C and the possibility to combine total scattering and small-angle scattering.

The P07-DESY branch is a high energy X-ray diffraction beamline specializing in small-beam experiments as the X-ray beam is routinely focused down to 2 µm × 30 µm (vertically × horizontally) at the sample position. The focusing capabilities enable spatially resolved techniques such as computed tomography (CT) with diffraction and PDF contrast (XRD/PDF-CT) as well as grazing incidence scattering studies of surfaces and thin films. In situ chambers for film deposition and heating in grazing incidence are available at the beamline.

The possibilities at the beamlines are presented to showcase the offered available techniques to the crystallographic user community.