Poster

The Powder Diffraction and Total Scattering Beamline P02.1 at PETRA III, DESY

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Powder Diffraction is a well-established method which allows to investigate long-range order structural properties of crystalline materials. On the other hand, Total Scattering measurements in combination with the Pair Distribution Function method is an expanding and powerful technique which allows to investigate the short-range and/or long-range order at the same time, making it possible not only to investigate crystalline materials, but also amorphous solids or liquids. Therefore, the combination of both methods provides a detailed insight into the structure of a wide range of material systems, including organic materials such as pharmaceuticals, co-crystals, covalent-organic frameworks, polymers and fibers, metal-organics such as metal-organic frameworks and inorganic materials such as nanoparticles, ceramics, cements, battery materials, metals and steels, metallic glasses, minerals and mineral glasses, superconductors, strongly (electron-)correlated materials, corrosion products, melts, liquids and so forth. For this huge range of crystalline and non-crystalline materials, structural properties, phase transitions or phase mixtures can be investigated at synchrotron facilities in *ex situ*, *in situ* or *in operando* experiments utilizing either beamline-offered or user-developed sample environments. With this widely covered range of material systems, Powder Diffraction and Total Scattering are extremely suited to investigate the state and consistency of all kinds of cultural heritage objects in a non-destructive way.

The Powder Diffraction and Total Scattering Beamline P02.1 at the PETRA III synchrotron at the DESY facility in Hamburg, Germany, is a specialized station, where researchers from science and industry have the possibility to collect Powder Diffraction and Total Scattering data simultaneously with a fixed energy of 60 keV [1, 2]. In recent years, the station has undergone major upgrades. For example, instead of using a single area detector, a custom-made tandem detector setup was installed, allowing users to measure simultaneously high-resolution Powder Diffraction data and Total Scattering / Pair Distribution Function data on the same sample or the same in situ process. Moreover, the old collimator tube was replaced by a flexible telescopic collimator tube allowing the last pin hole to get close to the sample or experiment. This suppresses the undesirable air scattering in front of the sample and therefore leads to a better data quality especially when Total Scattering data is collected. On the sample environment side, a new cryostat with a wide-opening angle was purchased, which will allow also to measure Total Scattering data down to temperature of 4 K. Currently this device is commissioned still under commission but will be available soon.

Besides regular on-site synchrotron experiments, users can also apply for mail-in / rapid access services for Powder Diffraction and/or Total Scattering / Pair Distribution Function measurements of samples packed in capillaries.

In this presentation, we will inform the scientific community as well as industrial customers about the latest developments at beamline P02.1.

[1] Dippel, A.-C., Bindzus, N., Saha, D., Delitz, J. T., Liermann, H.-P., Wahlberg, N., Becker, J., Bøjesen, E. D. & Iversen, B. B. (2014). *Z. Anorg. Allg. Chem*. **640**, 3094.

[2] Dippel, A.-C., Liermann, H.-P., Delitz, J. T., Walter, P., Schulte-Schrepping, H., Seeck, O. H. & Franz, H. (2015). *J. Synchrotron Radiat*. **22**, 675.