

Multi-modal, multi-scale laboratory X-ray imaging from life sciences to industrial application

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Multi-modal and multiscale-scale X-ray imaging techniques are being actively developed and applied at the Centre for X-ray Analytics of Empa. These include sub-micron X-ray computed tomography (CT) on soft and small-scale samples mostly from life sciences and biological applications, to 3D tomography on large and dense industrial and environmental samples. Application examples will be shown ranging from hard metallic samples, additive manufactured parts, porous materials to soft industrial materials, wood and polymers. Energy and elemental selective CT another interesting technique enabling a wide range of applications from biology to material sciences. Besides, absorption-based X-ray CT, another imaging modalities are also developed and applied that were previously mostly available only on synchrotron sources such as phase contrast and dark field imaging. To this end, two dedicated laboratory phase-contrast imaging setup featuring a Talbot-Lau grating interferometer has been developed to image soft samples. Grating interferometry is routinely used at lower energies enabling imaging of soft tissues and soft materials. To enable higher energy phase –contrast imaging for more attenuating samples, next to the grating-based interferometric setup, micro focus tubes are used to perform alternative approaches such as propagation-based imaging. Another such technique is a speckle-based phase –contrast and dark-field imaging. Application examples will also be shown for the latter in the talk including e.g. materials with submicron-scale porosity.