X-ray emission spectroscopy in the tender and hard X-ray regime at the Swiss Light Source and SwissFEL

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This talk will provide an overview of the X-ray emission spectrometers and methods developed for specific applications in the tender and hard X-ray regimes at the Swiss Light Source (SLS) and SwissFEL.

At the SuperXAS beamline of the SLS both a dispersive von Hamos spectrometer (used mainly for non-resonant XES, RXES and HEROS) as well as a scanning Johann spectrometer (used mainly for valence to core XES) are available for the 4-12 keV range. For the speciation of sulphur under in situ conditions, a dedicated von Hamos setup including cell is available for operando non-resonant S K_α XES measurements. The von Hamos spectrometer has been introduced at the superXAS beamline already in 2012 and found application for a new technique, so-called high energy off resonant emission spectroscopy (HEROS), which allows to measure high resolution XAS like spectra in a single shot free of self-absorption and now finds application at XFELs. For non-resonant XES in the 15-26 keV range a newly develop DuMond spectrometer is available.

At the Alvra endstation at SwissFEL a multi-crystal von Hamos spectrometer is available for RXES, non-resonant XES and HEROS in the tender and hard X-ray regime.

At the microXAS beamline a von Hamos spectrometer is available with a set of segmented crystals of 25 cm diameter. Enhanced spectral resolution is combined with micro-focused beams to obtain unique spatially resolved chemical information. Scanning resonant and non-resonant XES is employed to generate two-dimensional chemical images. Furthermore, non-resonant XES is explored as promising modality for three-dimensional chemical tomography of micro-structured materials and objects.

At the PHOENIX beamline, an undulator based beamline, which operates in the tender X-ray range (0.4-8 keV), a new compact von Hamos spectrometer was installed. The spectrometer covers the energy range from 2.1 keV to about 4.8 keV, and offers an energy resolution of about 0.4 eV.