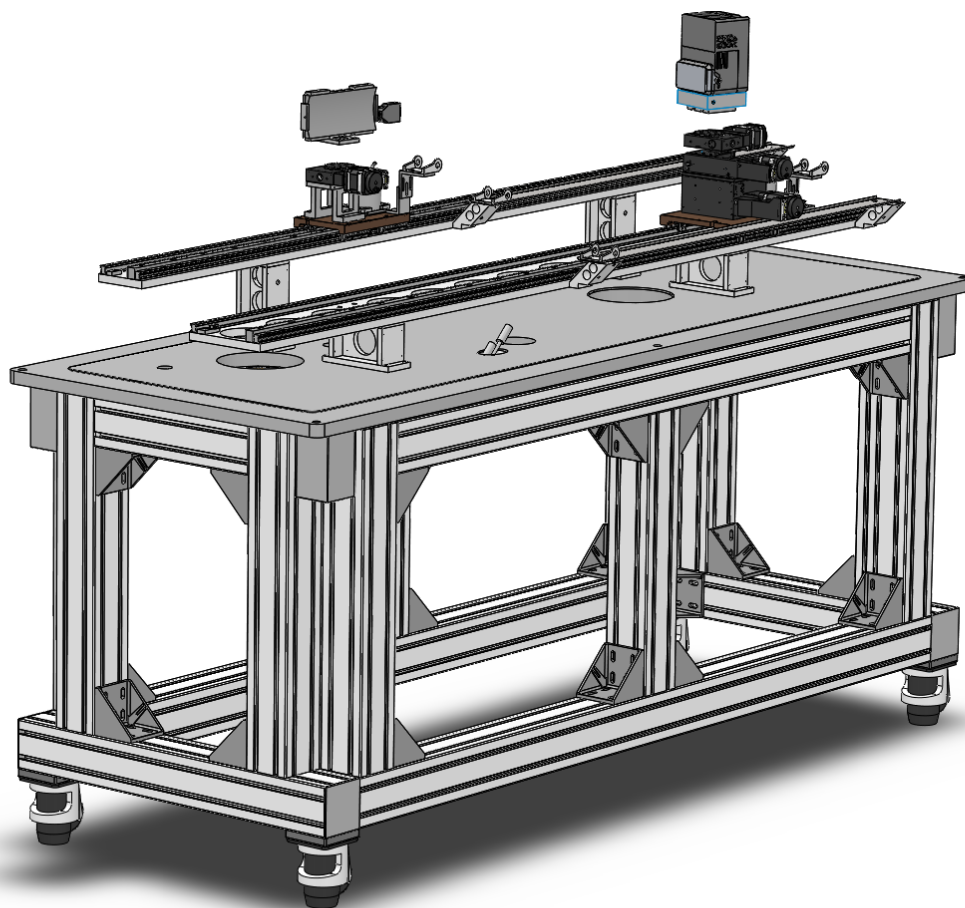


hiXAS

INTEGRATED XAS SOLUTION

X-ray



hp spectroscopy

hiXAS

Features

Table-top XAS system

- first integrated lab-based EXAFS and XANES solution
- no need to apply and wait for beamtime
- fast polychromatic acquisition enabling in-situ/in-operando measurements
- software suite for spectra analysis

Synchrotron-quality spectra

- energy range 5 to 12keV
- high resolving power of 4000
- wide bandpass of up to 1keV
- extreme sensitivity for analyte concentrations to a few wt%
- flexible switching between EXAFS and XANES mode

Applications

- chemical state analysis for geology, biology, materials research
- information on atomic distances, oxidation state, coordination number
- analysis of K-absorption edges of 3d-transition metals



hiXAS in use in a laboratory environment. The modular technology platform provides customized systems, including very compact versions. Two ports for sample environments allow for comfortable switching between different sample types, e.g. powder, foil, liquid cell.



View of crystal and detector setup inside hiXAS. The HAPG crystal is specifically optimized to the target application. Extremely high resolving power and high efficiency are obtained simultaneously. The hybrid detector with large sensor area enables in-situ measurements.

XANES analysis

Table-top XAS system

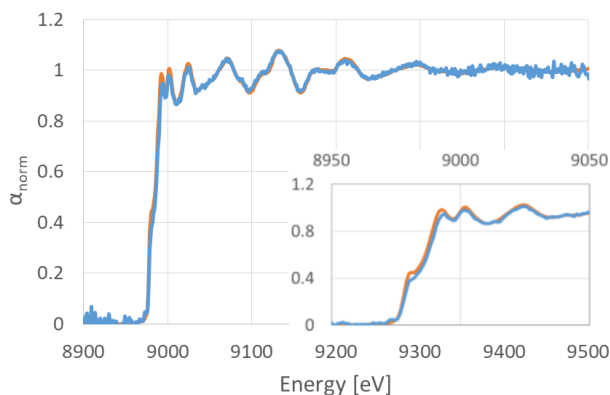
- structure analysis near x-ray absorption edge
- provides information on oxidation state, coordination number, covalency, and site symmetry of molecule
- extreme sensitivity for analyte concentrations to a few wt%

Synchrotron-quality spectra

- all spectral features of synchrotron measurements are accurately reproduced, allowing for advanced analysis of chemical state
- high resolving power of 4000
- wide bandpass of up to 600eV

In-situ measurements

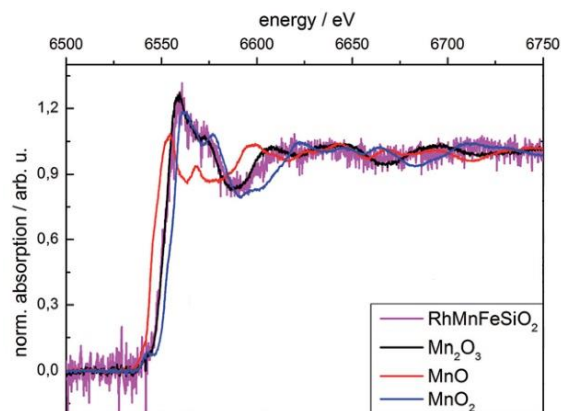
- fast polychromatic acquisition enables in-situ/in-operando measurements
- large benefits for catalyst characterization probing the dynamic interactions in-situ and in-operando



XANES spectrum of a 10µm-thick Cu foil from hiXAS (resolving power $E/\Delta E = 4000$, blue line) and comparison to a synchrotron measurement (APS beamline 13-ID-E, resolving power $E/\Delta E = 8000$, orange line).

The excellent agreement demonstrates the high quality result of hiXAS. Measurement time 8min.

J. Anal. At. Spectrom. 35 2298 (2020)



Oxidation state analysis of a nanoparticle catalyst for synthesis gas conversion. Mn and Fe are added as promoters for tuning the selectivity of the reaction.

Despite a Mn content of only 1.4wt%, the hiXAS measurement in comparison with reference spectra clearly indicates the oxidation state.

Faraday Discuss. 208 207 (2018)

EXAFS analysis

Table-top XAS system

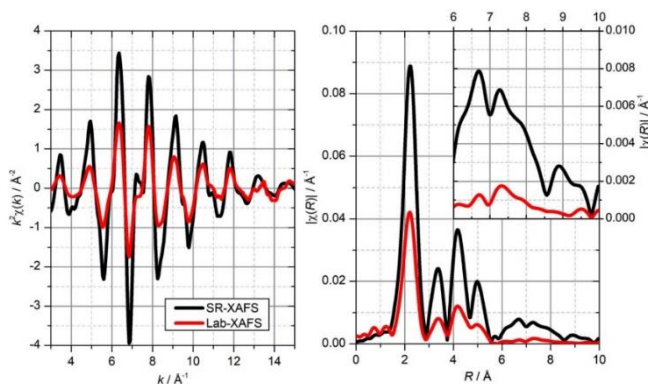
- structure analysis in extended range of absorption edge
- provides information on interatomic distances and near-neighbor coordination numbers
- large spectral bandwidth combined with high flux

Synchrotron-quality spectra

- high-efficiency HAPG crystal provides the high photon flux crucial for EXAFS ($> 10^7$ ph/s)
- extremely wide bandpass of 1000eV
- high resolving power of 1800, constant over full range

In-situ measurements

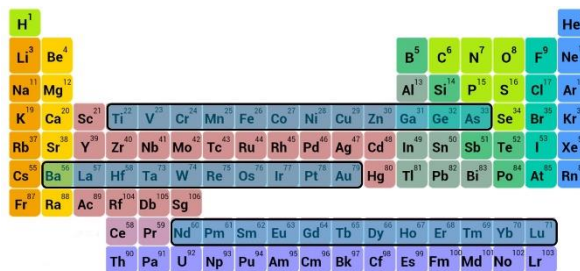
- fast polychromatic acquisition of large energy range enables novel in-situ/in-operando measurements
- non-equidistant spectra evaluation provides improved signal-to-noise for large wavevectors



Sample XAFS measurement of hiXAS of a 10 μ m Cu foil, comparing lab-based (red lines) and synchrotron (black lines) results. EXAFS oscillations (left) and corresponding Fourier transformation (right).

All peak positions are accurately reproduced. Measurement time 3min.

J. Anal. At. Spectrom. 35 2298 (2020)



Primary range of elements accessible for EXAFS and XANES measurements with hiXAS. Absorption edges at higher energies can be investigated with longer measurement times.

Specifications

Topology	X-ray tube source von Hamos HAPG spectrometer hybrid detector
Energy range	5-12keV, higher energies with longer measurement times
Analyte concentration	down to a few wt%
Sample mount	two sample ports, turret mounts for multiple samples (powder, foils, liquid cell)
Footprint	2.0m x 1.0m
Software suite	integrated system control, variety of spectra calibration and analysis functions

	EXAFS mode	XANES mode
Resolving power	1800	4000
	constant over the whole energy range	
Energy bandpass	1000eV	600eV
Acquisition time	3min	8min
	normalized to analyte concentration	

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