SIGRAY

QuantumLeap

H2000 & V210 X-RAY ABSORPTION SPECTROSCOPY SYSTEMS

Quantum Design EUROPE

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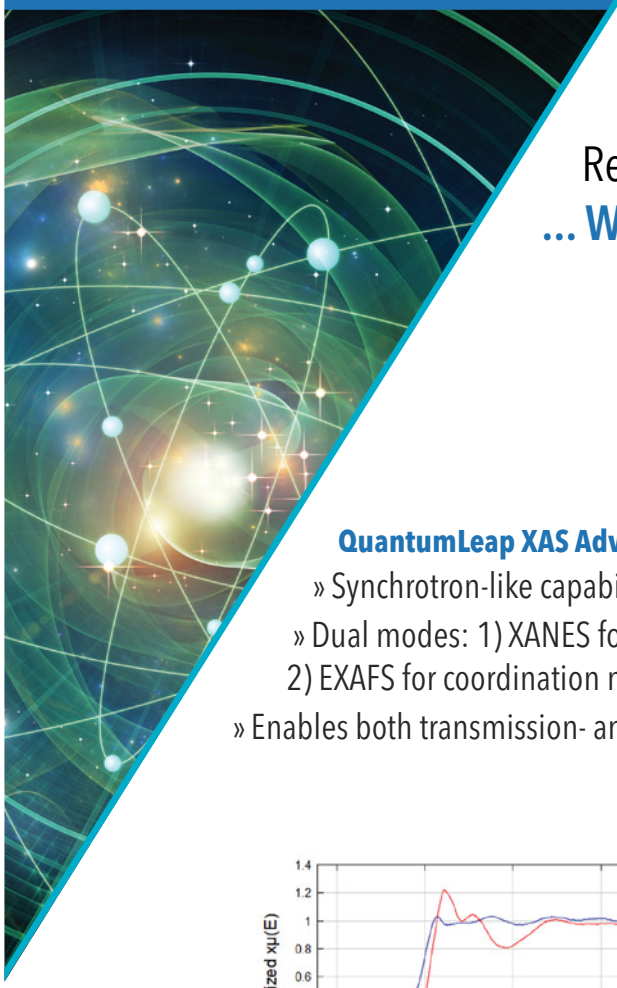
QuantumLeap
H2000 & V210 X-Ray absorption spectroscopy system

QuantumLeap uniquely enables insight into the electronic structure of elements of interest, including oxidation state and bond lengths.



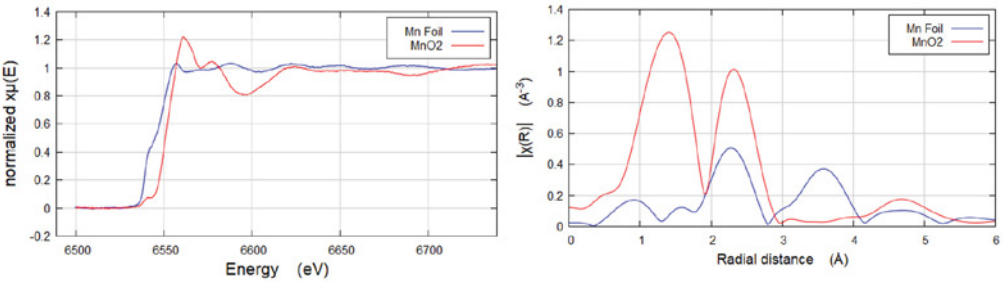
Chemical State Analysis
for Geology, Biology, Forensics & Materials Research
... Within Seconds

QuantumLeap XAS Advantages at a Glance

» Synchrotron-like capabilities to analyze electronic (chemical) state of elements

» Dual modes: 1) XANES for **oxidation state analysis** and bond covalency and 2) EXAFS for coordination number, types of donors, and interatomic distances

» Enables both transmission- and **fluorescence**-mode XAS for major to trace analysis



EXAFS spectra for Mn: Left: QuantumLeap results shown of a pure Mn and MnO2 sample. Right: Athen analysis of the EXAFS spectrum.

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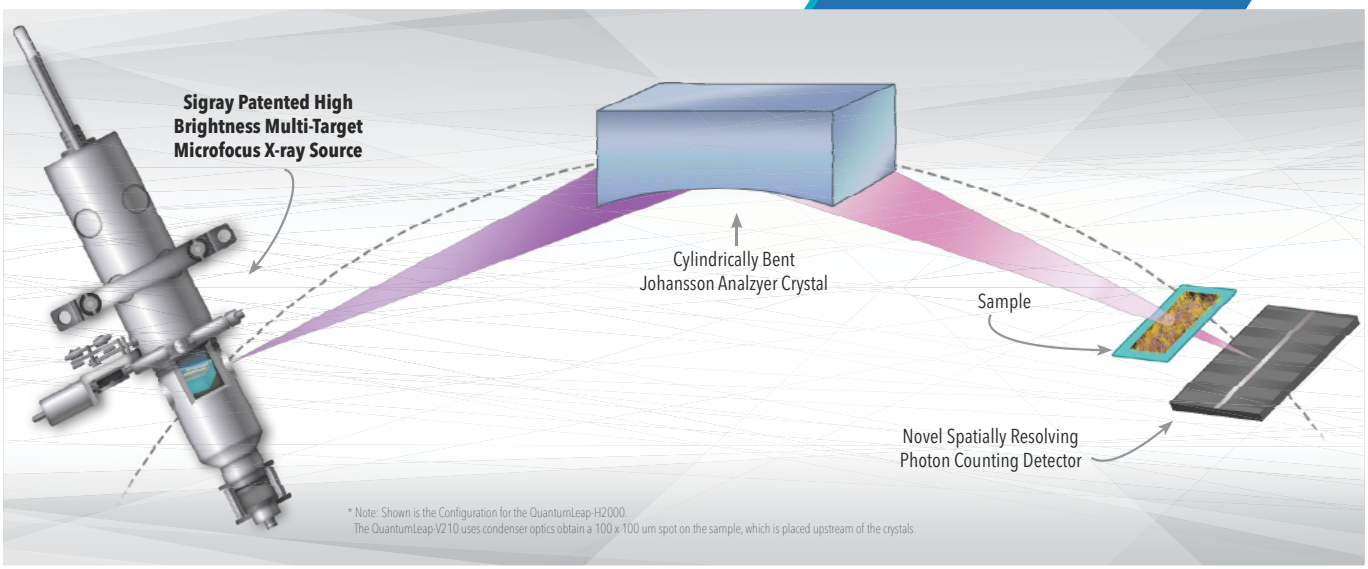
Patented approach uses an ultrahigh brightness multi-target x-ray source, which provides optimal performance for demanding XAS applications.



Finally... Synchrotron XAS Capabilities in Your Lab

Conduct Chemical State Analysis without Needing to Apply for Beamtime

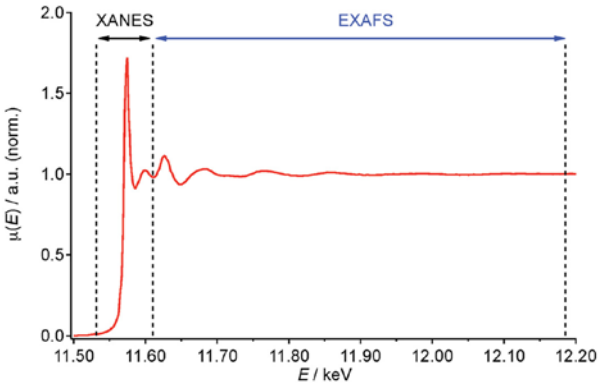
Sigray's QuantumLeap™ product line brings the long-awaited power of x-ray absorption spectroscopy (XAS), a synchroton technique for determining electronic structure of elements, to individual laboratories. With QuantumLeap, researchers will now be able to identify and quantify the chemical species of elements of interest.

What is XAS?

X-ray absorption spectroscopy (XAS) is a technique in which the x-ray energy is scanned in incremental steps near the specific absorption edge (binding energy) of an element of interest. At this energy, x-rays typically are absorbed by an electron that is then emitted from the atom. XAS is comprised of two regimes: XANES and EXFAS.

» The near-edge XANES region contains features and shifts in the absorption peak values caused by the transition of core electrons to non-bound levels, and is sensitive to local atomic states such as oxidation states.

» Extended fine structure (EXAFS) above the edge are formed by the wave-like nature of the emitted photoelectron, which is scattered by surrounding atoms and forms oscillations from constructive and destructive interference that can be then used to infer bond lengths and information on neighboring atoms.



Dual Modes of XAS: The Sigray QuantumLeap™ provides a "quantum leap" in laboratory compositional analysis by providing access to XANES at sub-eV and high throughput EXAFS. XANES provides local atomic information such as valence state and geometry; EXAFS provides interatomic information such as interatomic distances, near neighbor coordination numbers, and lattice dynamics.

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» QuantumLeap-V210 is a **microspot transmission-mode XAS system** with spot sizes down to 100 x 100 µm. The system is designed in a **vacuum enclosure**, ideal for researchers interested in low Z atomic numbers.

» QuantumLeap-H2000 is a hybrid XAS system that offers both transmission-mode and fluorescence-mode XAS. It is the **first commercial system with fluorescence-mode** XAS capabilities. The system is an ambient system, with line focus spots reaching 50 µm in the short dimension and 1-2 mm in the long dimension.

Both systems feature the ability to map chemical states across the sample at their respective spot sizes and both enable overnight recipe-based acquisition of multiple samples and/or points.

To select the ideal system for your research needs, please refer to the following simplified comparison chart:

Parameter	Sigray QuantumLeap V210	Sigray QuantumLeap H2000
Energy Coverage	1.7 - 10 keV (Down to phosphorus and sulfur)	4.5 - 25 keV (Down to scandium and titanium)
XAS Acquisition	Transmission XAS	Hybrid: Transmission & Fluorescence XAS
Energy Resolution	XANES: Down to 0.7 eV EXAFS: <10 eV (0.7 eV using XANES mode)	XANES: Down to 0.7 eV EXAFS: 5-15 eV (0.7 eV using XANES mode)
Low Z Path	Completely enclosed in vacuum	Helium flight path
Optimal Focus at Sample	100 x 100 µm	50 µm x 1 mm
Acquisition Approach	Dispersive; uses Sigray's high efficiency mirror lens to concentrate beam onto sample. Transmitted x-rays are dispersed by a crystal and entire spectrum is acquired simultaneously	Scanning; uses a custom line focus Sigray source coupled to a Johannsson crystal to monochromatize the incident beam. Energy stepping occurs when the crystal is rotated.
Patented Multi-Target Microstructured Diamond Source	☒	☒
Overnight Recipe Acquisition	☒	☒
In-situ options	Offered upon request	Offered upon request

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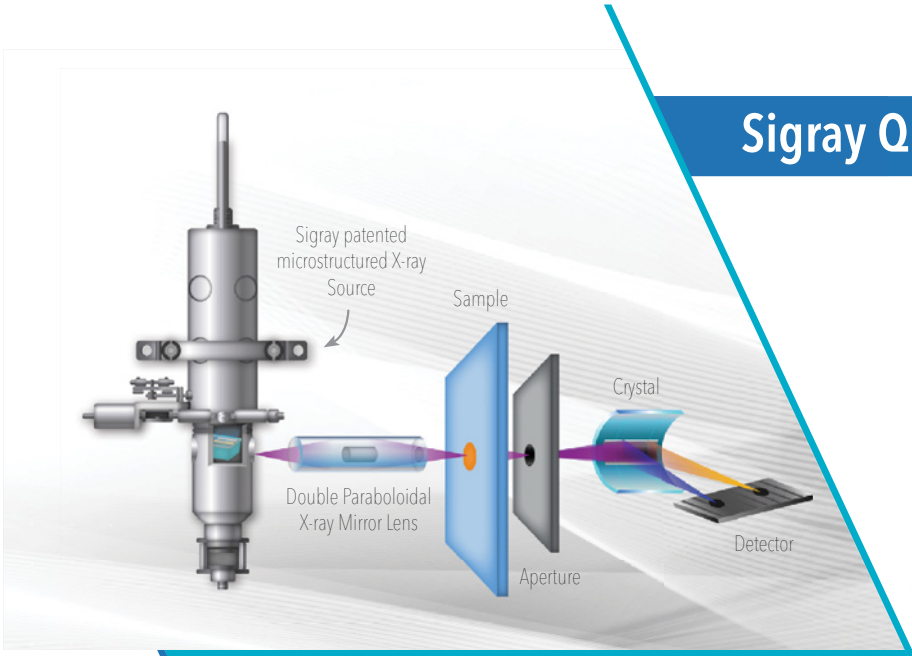
Sigray QuantumLeap-V210



» Transmission-mode XAS system in dispersive geometry

» Vacuum enclosure system enables optimal performance for low Z (e.g. Phosphorus and Sulfur) to transition metals

Specifications
QuantumLeap-V210™

Parameter	Specification
Spot Size at Sample	100 x 100 µm (symmetric spot)
Energy Coverage	1.7 - 10 keV Vacuum enclosure for low Z elements
Energy Resolution	XANES: Down to 0.7 eV EXAFS: <10 eV (EXAFS can also be acquired in XANES mode if sub-eV resolution is desired)
Crystal Analyzers	HAPG/HOPG, Ge (111), Ge (220), Ge (400). Others on request.
Source	Sigray Patented High Brightness Microfocus Source
Target Materials	Five element source Dual energy of W and Mo to enable removal of spectral contamination Additional transition metals: Cr, Fe, Cu for calibration
Voltage	20-50 kV
X-ray Optics	Sigray proprietary high efficiency double paraboloidal x-ray mirror lens
X-ray Detector	Spatially resolving photon counting detector

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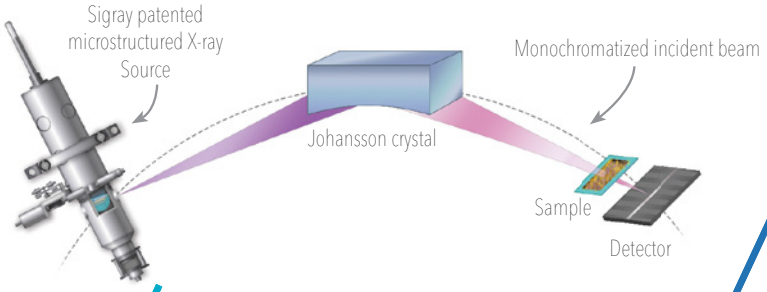

» "Hybrid" system for both transmission-mode and **fluorescence-mode** XAS
» Optimized for transition metals and lathanides
» Low Bragg-angle scanning acquisition

Sigray QuantumLeap-H2000

Specifications
QuantumLeap-H2000™

Parameter	Specification
Acquisition Mode(s)	Transmission and Fluorescence modes
Spot Size at Sample	50-100 µm x 1-2 mm (asymmetric spot)
Energy Coverage	4.5 to 25 keV
Energy Resolution	XANES: Down to 0.7 eV EXAFS: ~5-15 eV (EXAFS can also be acquired in XANES mode if sub-eV resolution is desired)
Operation	Superior Patented Low Angle Acquisition Approach Achieves down to 15 degrees Bragg angle acquisition
Crystal Analyzers	3 Johansson single crystal analyzers and 1 mosaic crystal Options for up to 5 crystals
Source	Sigray Patented High Brightness Microfocus Source
Target Materials	Five element source Dual energy of W and Mo to enable removal of spectral contamination Additional transition metals: Cr, Fe, Cu for calibration
Voltage	20-50 kV
Transmission-mode Detector	Spatially resolving photon counting detector (patented design)
Fluorescence-mode Detector	Silicon drift detector

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