

# QUICK X-RAY ABSORPTION AND SCATTERING (QAS)

## SCIENTIFIC SCOPE

QAS (Quick x-ray Absorption and Scattering) will enable *in situ* studies of chemical and physical transformations by both quick and regular x-ray absorption and scattering measurements. It will provide for the investigation of fast kinetics of samples from the fields of catalysis, energy storage/conversion, and other scientific disciplines. It will allow measurements using separate and combined XAS and XRD techniques, as well as combining these techniques with those provided by end stations with IR and Raman spectroscopy capabilities, in different sample environments.

## BEAMLINE CHARACTERISTICS

### TECHNIQUES:

- Quick and conventional XAS (transmission and fluorescence)
- Quick and conventional XRD

### DETECTORS

- PerkinElmer 1621 area detector
- Vortex-ME4 4-element Si-drift
- Canberra multi-element Ge
- Ion chambers
- Canberra PIPS

### SAMPLE ENVIRONMENTS

- Closed-cycle He refrigerators:  $T > 10\text{K}$
- In-situ Clausen cells:  $25^\circ\text{C} - 700^\circ\text{C}$
- In-situ Nashner-Adler reaction cells:  $-150^\circ\text{C} - 500^\circ\text{C}$
- Large Clam Shell furnace reactor:  $25^\circ\text{C} - 900^\circ\text{C}$
- In-situ high P, high T XAS flow cell:  $T$  to  $600^\circ\text{C}$  and  $P$  to 1200 psi (83 bar)
- In-situ, custom made XAS-DRIFTS cell:  $25^\circ\text{C} - 700^\circ\text{C}$

## Overview

**PORT:** 7-BM  
**SOURCE:** 3-pole wiggler  
**ENERGY RANGE:** 4.7 – 31 keV  
**ENERGY RESOLUTION:**  $\Delta E/E = 10^{-4}$   
**BEAM SPOT SIZE** (in focused mode): less than 1.0H x 0.5V (mm)  
**PHOTON FLUX:** up to  $10^{12}$  ph/s (10 keV)  
**CONSTRUCTION PROJECT:** NxtGen  
**BEAMLINE STATUS:** Construction  
**AVAILABLE TO USERS:** 2016

## Beamline Team

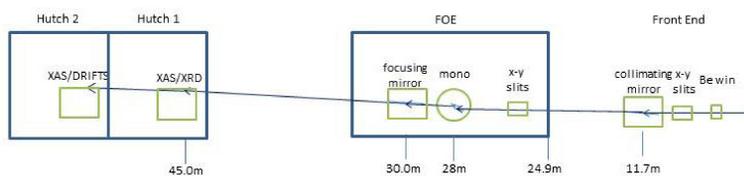
### STAFF

Steven N. Ehrlich: lead beamline scientist  
 Lukas Lienhard: mechanical engineer  
 Mike Johanson: designer

### BEAMLINE DEV. PROPOSAL LEAD

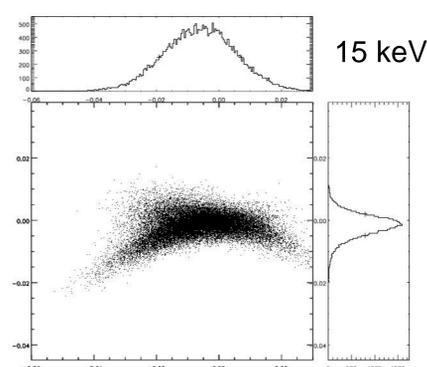
Anatoly Frenkel (Yeshiva University)

## BEAMLINE DESIGN



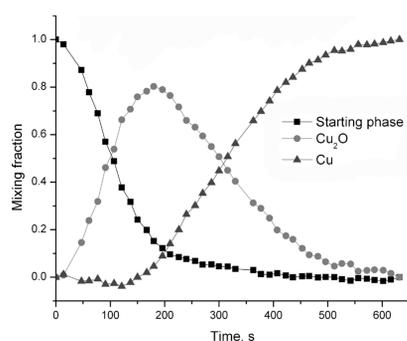
Collimating mirror – 700mm long; Rh and Pt stripes  
 Mono: quick-scan capable monochromator  
 Toroidal focusing mirror – 1000mm long; Rh-coated

## PERFORMANCE ESTIMATES

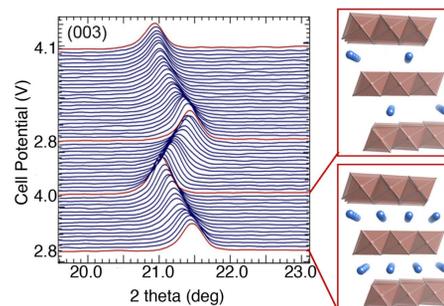


E (keV)	FWHM H (mm)	FWHM V (mm)	FWHM div H' (mrad)	FWHM div V' (mrad)	Estimated flux (ph/s)
5	0.255	0.070	1.28	0.123	6.4E11
10	0.260	0.064	1.24	0.129	7.9E11
15	0.262	0.067	1.21	0.130	5.4E11
20	0.270	0.063	1.20	0.114	2.9E11
25	0.263	0.059	1.18	0.110	1.1E11
30	0.257	0.057	1.21	0.092	3.8E10

## SCIENTIFIC APPLICATIONS



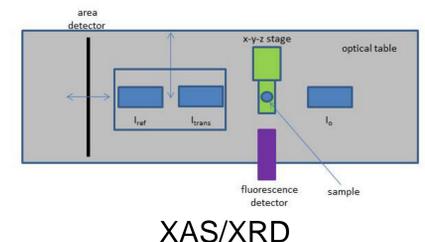
**CATALYSIS:** Investigations of structure, kinetics, dynamics and reactivity during *in situ* transformations with short time resolution



**ENERGY GENERATION AND STORAGE:** Understanding the physical and chemical processes in batteries and fuel cells



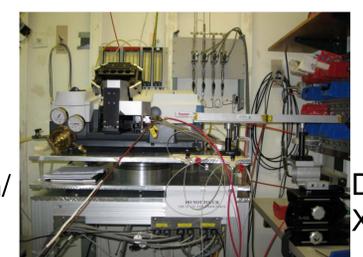
QEXAFS



XAS/XRD



Raman/  
XAS



DRIFTS/  
XAS

**COMPLEMENTARY PROBES:** Investigate complex interactions in systems at time scales from tens of ms to hours and length scales from Å to μm.