

## SCIENTIFIC SCOPE

Full-field X-ray Imaging (FXI) is a damping wiggler beamline at sector 18-ID providing world-leading x-ray microscopy with 30 nm spatial resolution and high speed image acquisition with complete 3D tomographic data sets in under 5 minutes. The key instrument at FXI is a Transmission X-ray Microscope (TXM). FXI will enable in-situ and in-operando 3D visualization of dynamics in a wide variety of systems such as energy storage devices, geological and environmental systems and materials science.

## BEAMLINE CHARACTERISTICS

### TECHNIQUES:

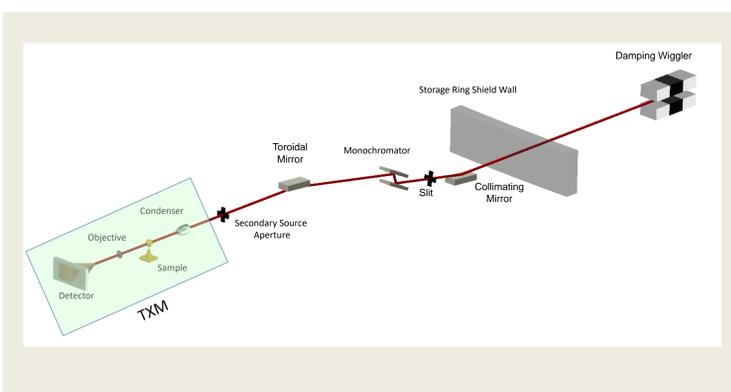
- Transmission X-ray Microscopy

### ENDSTATION DETAILS:

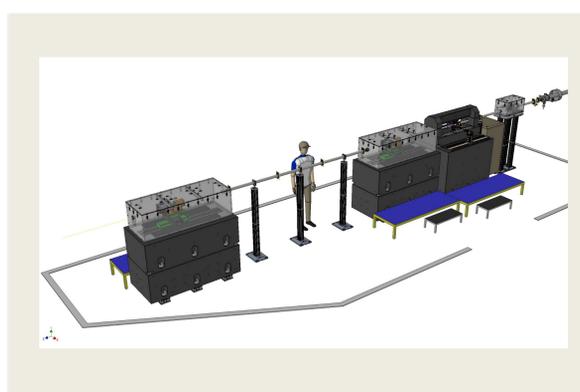
- Transmission X-ray Microscope
- In-situ nanotomography
- Nano-XANES capability
- Accepts environmental cells

### FXI at NSLS-II:

- World leader in performance TXM
- High-speed imaging at 30 nm resolution
- Detector frame rates up to 50 Hz
- Complete 3D data set in < 5 min
- In-situ and in-operando studies

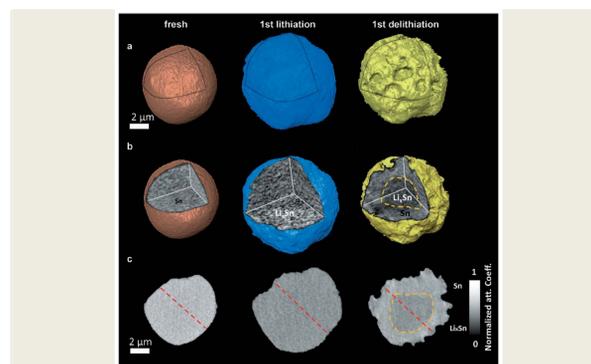


Schematic of the FXI beamline.



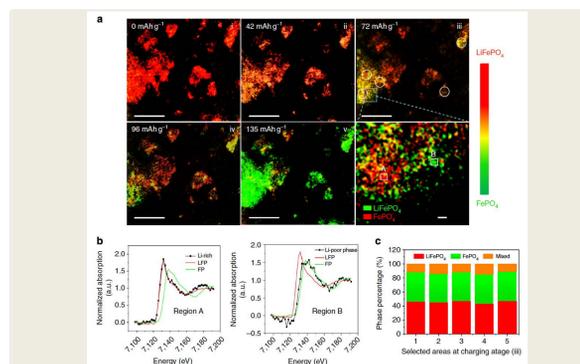
TXM instrument.

## SCIENTIFIC APPLICATIONS



In-situ 3D tracking of morphological changes in a Li-ion battery tin electrode. Figure shows the changes in one particle of tin within the electrode during the first lithiation and delithiation cycle.

[Wang et al, Angewandte Communications 53, 2014.]



In operando chemical mapping of LiFePO<sub>4</sub> battery electrode in a coin cell. (a) 2D chemical mapping; (b) XANES at selected regions at charging state iii; (c) histograms of phase composition at five selected regions at charging state iii. Scale bar: 10 μm for the five 2D maps, 200 nm for the enlarged map.

[Wang et al, Nature Communications 5, 2014.]

## Overview

**PORT:** 18-ID

**SOURCE:** Damping wiggler (DW100)

**ENERGY RANGE:** 5 – 11 keV

**ENERGY RESOLUTION:**  $\Delta E/E = 10^{-4}$

**SPATIAL RESOLUTION:** 30 nm

**FIELD OF VIEW:** 20-40 μm

**BEAMLINE STATUS:** In construction

**AVAILABLE TO USERS:** Fall 2018

**BEAMLINE PHONE:** 631.344.1618

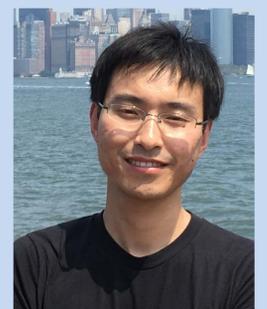
**BEAMLINE WEBSITE:**

[www.bnl.gov/nsls2/beamline/18-ID](http://www.bnl.gov/nsls2/beamline/18-ID)

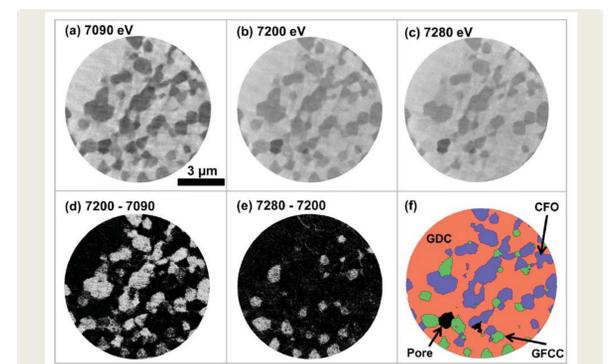
## Beamline Staff



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Lead Beamline Scientist



**Mingyuan Ge**  
Beamline Scientist



X-ray nanotomography cross-sectional slices of a ceramic for use in solid oxide fuel cells (SOFC) consisting of a Ce<sub>0.8</sub>Gd<sub>0.2</sub>O<sub>2</sub> (GDC) oxygen ion conductive phase and a CoFe<sub>2</sub>O<sub>4</sub> (CFO) electronic conducting phase. An emergent phase Gd<sub>0.374</sub>Ce<sub>0.079</sub>Fe<sub>0.47</sub>O<sub>x</sub> (GFCC) was detected. [Harris et al, Nanoscale 6, 2014.]