



... for a brighter future

## ***Upcoming APS Summer Schools***

### ***9th U.S. National School on Neutron & X-Ray Scattering***

August 12–25, 2007

Argonne Division of Educational Programs

### ***3rd APS XAFS Summer School***

July 23–27, 2007

APS XAFS Scientific Interest Group and APS User Office

### ***School for Liquid Surface X-ray Scattering***

November 7–9, 2007

ChemMatCARS



U.S. Department  
of Energy

UChicago ►  
Argonne<sub>LLC</sub>



# U.S. National School on Neutron & X-Ray Scattering:

*“To educate graduate students on the utilization of major neutron and x-ray facilities”*

## Experiments

- Powder Diffraction
- Small Angle Scattering
- Reflectivity
- Inelastic Scattering
- Quasi-elastic neutron scattering
- Liquids and Amorphous Scattering
- Stress/Strain/Texture
- Reflectivity
- EXAFS
- Single Crystal Diffraction
- Magnetic Dichroism
- Coherent X-ray Scattering
- X-ray Microprobe

## Lectures

- Interactions of X-rays and Neutrons with Matter
- Neutron Generation and Detection
- Neutron Instrumentation
- X-ray Generation and Detection
- X-ray Instrumentation
- Single-Crystal and Surface Diffraction
- Powder Diffraction
- Inelastic Scattering
- Reflectivity
- Magnetic Scattering
- EXAFS
- Small Angle Scattering
- Diffuse Scattering
- Nuclear Resonant Inelastic X-ray Scattering
- Coherent X-ray Scattering
- Amorphous Scattering

## ***NX School: August 12 – 25, 2007***

- **Application Deadline:** May 28, 2007
- Open to graduate students attending U.S. universities
- Free. School provides transportation (up to \$500) and on-site housing.
- Local Organizing Committee
  - Raymond Osborn and Jonathan Lang, Scientific Directors
  - Harold Myron, Educational Director
  - Carol Reynolds, Conference Secretary
  - Ray Teller - IPNS
  - George Crabtree - MSD
  - Dennis Mills - APS
  - Jan Ilavsky, Experimental Coordinator - APS
  - Chris Benmore, Experimental Coordinator - IPNS

# 2007 APS XAFS Summer School

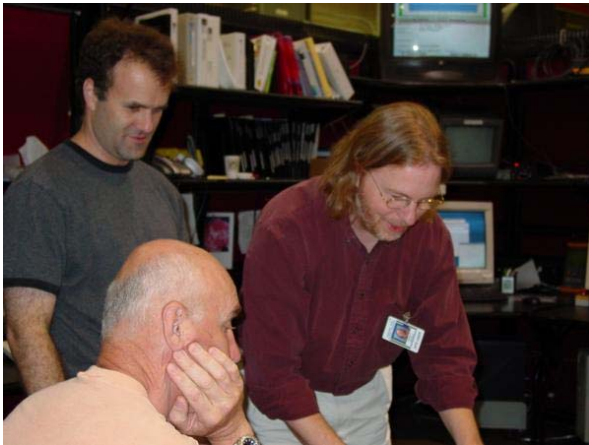
*“A comprehensive introduction to best practices in collection and analysis of XAFS data”*

## Labs & Experiments

- Sample Preparation
- Data Collection (6 Shifts at 5 Beamlines)
  - 5-BM-D
  - 8-BM
  - 10-ID
  - 12-BM
  - 20-BM
- Data Processing and Analysis (2 Days)

## Lectures

- XAFS Theory
- Interpretation of XANES Data
- Detectors and Optics
- Model Building
- Beamline Instrumentation
- Reporting Standards



## ***APS XAFS School: July 23 – 27, 2007***

- **Application Deadline:** June 25, 2007
- Open to anyone interested in learning about XAFS and how to incorporate XAFS into their own research program.
- Registration \$375; Students arrange own housing and transportation.
- Organizing Committee
  - Julie Cross, APS
  - Bruce Ravel, ANL (MR-CAT)
  - Shelly Kelly, ANL (MR-CAT)
  - Matt Newville, University of Chicago (GSECARS)
  - Robert Gordon, Simon Fraser University (XOR/PNC)
  - Susan Strasser, APS

# APS XAFS School: Impact

“The XAFS school has been quite helpful. I published my first EXAFS paper in 2006 in Chem. Mater., believe it or not, using some of the data I got from that summer session on Pt on CNTs, which also received attention as an NSLS Science Highlight. This year, I've submitted a manuscript to Environ. Sci. Tech. in January and am working on a UO<sub>2</sub> nanoparticle manuscript inspired by Shelly Kelly's work.”

Charles C. Chusuei, Ph.D., Assistant Professor, Chemistry Department, University of Missouri



## Science Highlights

from the National Synchrotron Light Source

**BEAMLINE**  
X18B

**PUBLICATION**

R.V. Hull, L. Li, Y. Xing, and C.C. Chusuei, "Pt Nanoparticle Binding on Multiwalled Carbon Nanotubes", *Chem. Mater.*, **18**, 1780–1788 (2006).

**FUNDING**

American Chemical Society Petroleum Research Fund; Foundation for Chemical Research, Inc.; Missouri Research Board; UMR Intelligent Systems Center

**FOR MORE INFORMATION**

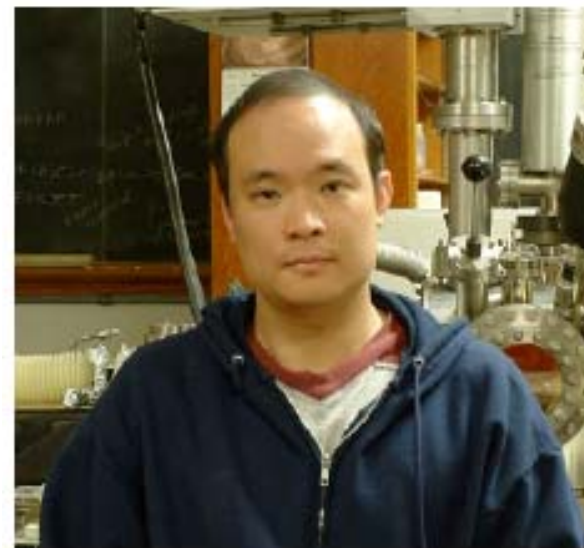
Charles C. Chusuei, Chemistry Department, University of Missouri-Rolla  
chusuei@umr.edu

### Characterizing the Surfaces of Carbon Nanotube Fuel Cell Catalysts

R.V. Hull<sup>1</sup>, L. Li<sup>2</sup>, Y. Xing<sup>2</sup>, and C.C. Chusuei<sup>1</sup>

<sup>1</sup>Department of Chemistry and <sup>2</sup>Department of Chemical and Biological Engineering, University of Missouri-Rolla

*Characterizing the surface structure of catalyst materials is important for the improvement of current fuel cell technology, which promises to deliver an environmentally benign means of energy production. Using x-rays produced at the National Synchrotron Light Source (NSLS), researchers at the University of Missouri-Rolla (UMR) were able to detect the presence of PtO<sub>x</sub> at the outer-most perimeters of a potential catalyst: platinum nanoparticles tethered to carbon nanotubes. At the same time, they determined that its bulk composition was predominantly metallic.*



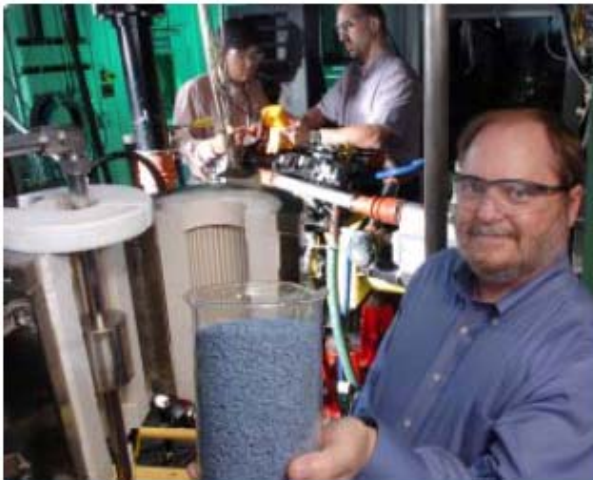
Charles Chusuei



# APS XAFS School: Impact

“Your school was extremely valuable for me. I routinely do work out at sector 10 (MRCAT) and make use of my training on Athena and Artemis. I plan on sending one or two post docs to the school this summer.”

Christopher L. Marshall, Ph.D., Argonne Chemical Engineering Division



**NO<sub>x</sub> KILLER** — A catalyst developed by Argonne researchers could help diesel truck manufacturers eliminate harmful nitrogen-oxide emissions from diesel exhausts. The catalyst, currently being tested in the form of extrudates, is shown here by researcher Chris Marshall. Having performed well in lab tests, the next step is to subject the catalyst to testing using real diesel exhaust. These tests will take place soon at Argonne’s Diesel Engine Test Facility. The catalyst will be placed in the reactor at left which is then connected to the diesel engine pictured in the background with post-doctoral researcher Sundar Krishnan, left, and Argonne researcher Steve Ciatti. Photo by George Joch



“With the help of the [Advanced Photon Source](#) at Argonne to analyze the structure and performance of various catalysts, Marshall's group at Argonne developed an additive that allows Cu-ZSM-5 and similar catalysts to overcome these difficulties.”

# APS XAFS School: Impact

“We published a nice Phys. Rev. B with knowledge gained during discussions and tutorials at the XAFS School, and we continue to apply these principles to our work today... Thanks a lot!”

Tonio Buonassisi, University of California, Berkeley

PHYSICAL REVIEW B 73, 235204 (2006)

## Complex intermetallic phase in multicrystalline silicon doped with transition metals

Matthias Heuer,<sup>1</sup> Tonio Buonassisi,<sup>1</sup> Matthew A. Marcus,<sup>2</sup> Andrei A. Istratov,<sup>1</sup> Matthew D. Pickett,<sup>1</sup> Tomohiro Shibata,<sup>3</sup> and Eicke R. Weber<sup>1</sup>

<sup>1</sup>*Department of Materials Science and Engineering, University of California, Berkeley and Materials Science Division, Lawrence Berkeley National Laboratory, Berkeley, California 94720, USA*

<sup>2</sup>*Advanced Light Source, Lawrence Berkeley National Laboratory, Berkeley, California 94720, USA*

<sup>3</sup>*Department of Physics, Illinois Institute of Technology, Chicago, Illinois 60616, USA*

(Received 7 March 2006; revised manuscript received 12 May 2006; published 8 June 2006)

We report the observation of an alloy phase with fluorite-type structure containing Ni, Fe, Cu, and Si, found as precipitates in multicrystalline silicon. The analysis of extended x-ray absorption fine-structure microspectroscopy ( $\mu$ -EXAFS) measurements on the *K* edges of the transition metals of the precipitates and a synthetic reference material with composition of  $\text{Ni}_{0.82}\text{Fe}_{0.21}\text{Cu}_{0.02}\text{Si}_{1.94}$  support a structure model similar to  $\text{NiSi}_2$  but with mixed occupancies of Fe on the Ni site and Cu on the Si site. This observation provides evidence that transition metals interact during precipitation within silicon and form complex silicides.



The screenshot shows the Argonne National Laboratory website. At the top left is the Argonne logo, a colorful triangle with the word "Argonne" and "NATIONAL LABORATORY" below it. To the right is the text "Advanced Photon Source" and "A U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences national synchrotron x-ray research facility". Below this is a navigation menu with dropdown arrows for "About", "Science", "Media Center", "User Information", "Education", and "Facility". A breadcrumb trail reads "Argonne Home > Advanced Photon Source > Science > Highlights > 2005 >". A blue banner at the bottom of the screenshot contains the text "Cheaper Silicon Found Effective for Solar Cells".



## APS XAFS School: Impact

R. V. Hull, L. Li, Y. Xing, and C. C. Chusuei, "Pt Nanoparticle Binding on Functionalized Multiwalled Carbon Nanotubes," *Chemistry of Materials* **18**, 1780-1788 (2006).

M. Heuer, T. Buonassisi, M.A. Marcus, A.A. Istratov, M.D. Pickett, T. Shibata, and E.R. Weber, "Complex intermetallic phase in multicrystalline silicon doped with transition metals," *Physical Review B* **73**, 235204 (2006).

P. Shanthakumar, M. Balasubramanian, D. M. Pease, A.I. Frenkel, D. M. Potrepka, V. Kraizman, J.I. Budnick, and W.A. Hines, "X-Ray Study of the Ferroelectric [Ba<sub>0.6</sub>Sr<sub>0.4</sub>] [(Yta)<sub>0.03</sub>Ti<sub>0.94</sub>]O<sub>3</sub>," *Physical Review B* **74**, 174103 (2006).

A. G. B. Williams, K. G. Scheckel, T. Tolaymat, and C. A. Impellitteri, "Mineralogy and Characterization of Arsenic, Iron, and Lead in a Mine Waste-Derived Fertilizer," *Environmental Science and Technology* **40**, 4874 (2006).

N. Weiher, A. M. Beesley, N. Tsapatsaris, L. Delannoy, C. Louis, J. A. Van Bokhoven, and S. L. M. Schroeder, "Activation of Oxygen by Metallic Gold in Au/TiO<sub>2</sub> Catalysts," *Journal of the American Chemical Society* **129**, 2240 (2007).

Murli H. Manghnani, Xinguo Hong, Matthew Newville, John Balogh, and G. Amulele, "Structural Investigation of Fe-Ni-S and Fe-Ni-Si Melts by High-temperature Fluorescence XAFS Measurements," *AIP Conference Proceedings* **882**, pp. 466-468

# Advanced Training in Other Synchrotron Techniques

“A comprehensive introduction to best practices in \_\_\_\_\_”

## NX-School Subjects

- Interactions of X-rays and Neutrons with Matter
- Neutron Generation and Detection
- Neutron Instrumentation
- X-ray Generation and Detection
- X-ray Instrumentation
- Single-Crystal and Surface Diffraction
- Powder Diffraction
- Inelastic Scattering
- Reflectivity
- Magnetic Scattering
- EXAFS
- Small Angle Scattering
- Diffuse Scattering
- Nuclear Resonant Inelastic X-ray Scattering
- Coherent X-ray Scattering
- Amorphous Scattering

## APS Scientific Interest Groups

- Catalysis
- High Pressure
- [Liquid and Soft-Matter Surface Scattering](#)
- Powder Diffraction
- SAXS
- Surface & Interface Scattering
- Tomography
- [XAFS](#)
- X-ray Microscopy & Imaging