

Portland State University

## PSU Creates Magnet Facility for Nanotechnology Research, Education and Training in Oregon

Leading-edge laboratory provides local access to the world's most advanced microscopy equipment and expertise

*“With FEI, we have a great partnership. FEI is always willing to help us.”*

— *Dr. Jun Jiao*

Director, CEMN, PSU

### Overview

The Center for Electron Microscopy and Nanofabrication (CEMN) at Portland State University (PSU) is a magnet site for non-profit and multi-user research. CEMN, a signature research facility of the Oregon Nanoscience and Microtechnology Institute (ONAMI), was created to:

- **Support faculty research activities and collaboration between PSU, University of Oregon, Oregon State University, Oregon Health and Science University, and Pacific Northwest National Laboratory**
- **Prepare students for future careers in science and technology**
- **Promote interaction between PSU and the greater community**

CEMN at Portland State University is a signature research facility of the Oregon Nanoscience and Microtechnology Institute (ONAMI). Partnership between FEI and PSU resulted in a world-class lab that includes a Tecnai TEM/STEM, Sirion SEM, DualBeam and Phenom SEM.

Beginning from scratch in 1999, the lab has evolved over the years, adding more advanced technology as increased funding was obtained. The Center's director, Dr. Jun Jiao, focuses her research on the development of nanofabrication techniques for the property-controlled growth of nanotubes and nanowires. She also investigates carbon nanotubes and semiconductor nanowires for use as building blocks for nanoelectronic devices and next-generation electron field emitters. Her nanomaterials research is documented in more than 100 publications in refereed journals and two patents.

Dr. Jiao sought out the world's leading-edge microscopy equipment for CEMN. After reviewing competitive equipment, Dr. Jiao chose SEMs and TEMs from FEI. PSU and FEI fostered a collegial approach that helped establish a magnet facility that attracts scores of researchers, educators, and students.

## Challenge

The establishment of CEMN is part of PSU's commitment to enhance research activity and to support the needs of academic institutes and companies in the greater Portland area for advanced materials characterization capabilities. The location and introduction of state-of-the-art facilities provide the physical basis for the success of CEMN. Researchers from participating institutions are able to access the CEMN by visiting the facility at PSU, or through remote-access high-speed Internet connections—enabling critical research to take place throughout Oregon.

To select the best-in-class microscopy tools, Dr. Jiao considered several factors. "The quality of the instrument is the first priority," said Jiao. However, beyond merely selecting high performance instruments, PSU wanted to partner with a company invested in the success of the nanotechnology research community. The lab's mission to create a locus for research was equally as important.

## Why FEI

In addition to specifying the lab's microscopy equipment, PSU also wanted to work with colleagues to exchange information and share their technical expertise.

"With FEI, we have a great partnership. FEI is always willing to help us, and we are willing to help them as well. We give each other feedback for future development. All these facts were considered," says Jiao.

"Our center is used by professors, faculty, students, local universities, research institutes, as well as private companies. We provide a rich source of information about how the instruments are used. For example, the center was one of the first sites for testing the Phenom™ desktop scanning electron microscope (SEM)," says Jiao.

## The Solution

Dr. Jiao and her colleagues assembled the best-in-class tools to further the region's research. Tools for community use include an FEI Tecnai F-20 transmission electron microscope (TEM); an FEI Sirion XL30 scanning electron microscope; a Strata™ DB STEM 237, an immersion field emission SEM with focused ion beam (FIB), for cutting, milling, depositing nanostructures,

and for TEM sample preparations; and Phenom SEM.

At CEMN, specimen imaging can be performed through TEM, STEM, and SEM while energy-dispersive X-ray spectroscopy (EDS) and electron energy loss spectroscopy (EELS) can provide

elemental analysis. All of the images and spectra are recorded digitally, facilitating data processing and transfer. The center's facilities are also available for nanofabrication including thin film deposition tools and nanostructure growth reactors. A semiconductor analyzer and a probe station are available for testing specimen electrical properties.

## The Result

"Having the Tecnai TEM allows us to examine the structure of materials at an atomic scale. The Sirion SEM allows us to view the surface morphology or topography. We can also create prototypes of nanodevices by using the FIB capabilities of our Strata DB STEM," says Jiao regarding the most sophisticated tools.

The acquisition of the low-cost Phenom SEM serves a valuable public need. "The Phenom is suitable for biological sample imaging. It provides a tool for outreach to high school students. It is very easy to use and not that expensive. We can allow children to play—seeing is believing. They see the fascinating nanostructure . . . it stimulates their curiosity, spurs their interest in science, and desire to pursue higher education," explains Jiao.

"We have a very broad range of equipment. Once you bring the sample into the center, you can get almost anything you need to understand and characterize materials and devices. This is very powerful to researchers and educators so they can attract more competitive grants to develop the research and education in this area," says Jiao.

"This center has been an indispensable infrastructure for many researchers. It also provides training for graduate students. Our mission is to establish first class nanotechnology research center, but also to train graduate students with a special skill that is very much in demand in society," concluded Jiao.

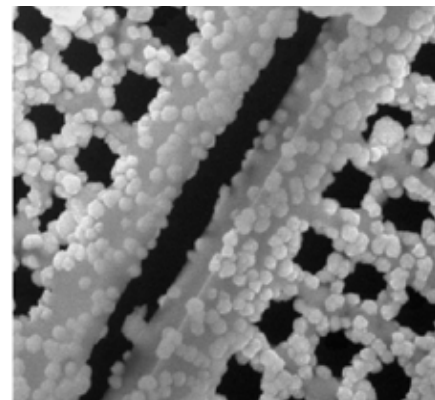


Fig. 1: CdS nanocrystals deposited on diatom cell walls.

**FEI Company**  
World Headquarters  
5350 NE Dawson Creek Drive  
Hillsboro, OR 97124-5793  
USA  
PH: +1.503.726.7500

**FEI Europe**  
PH: +31.40.23.56000

**FEI Japan**  
PH: +81.3.3740.0970

**FEI Asia Pacific**  
PH: +86.21.5027.8805

[fei.com](http://fei.com)