UTAH NANOFAB

An Overview

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See www.nanofab.utah.edu

NATIONAL SCIENCE FOUNDATION MRSEC MATERIALS RESEARCH SCIENCE & ENGINEERING CENTERS

THE UNIVERSITY OF UTAH

Overview

- **Context: the Utah MRSEC**
- **Background: Why Utah is interested**
- **The Utah Nanofab: Cleanroom & Microscopy**
- **Objectives in coming to NU:**
  - Recharge Model
  - Equipment Maintenance
  - Training Users
  - Logging/tracking/billing
  - Working with outside users
  - Remote instrument operation

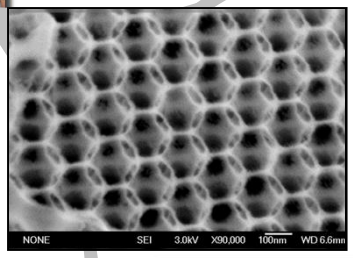
What is the Center About?

Diversity

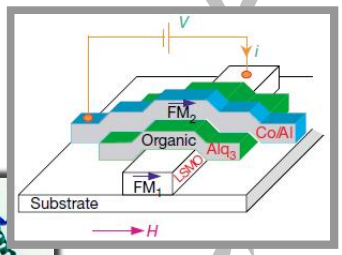
Collaboration

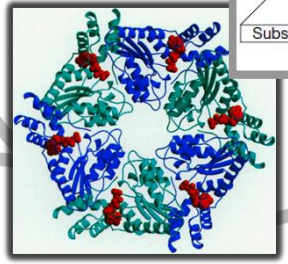
Education & Outreach

Plasmonics



Organic Spintronics





Seed Projects

State & Institutional Support

Facilities

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Aside––Outreach: Science Olympiad

- Annual state competition for middle and high school students; division winners advance to national competition
- Promotes hands-on learning experiences in science, technology, and engineering
- New event in Materials Science with emphasis on nano-materials

- **MRSEC: participant support $16k/year; $20k/year for materials & supplies + coordinator**
- **MRSEC is saving the state competition in Utah!**

Facilities

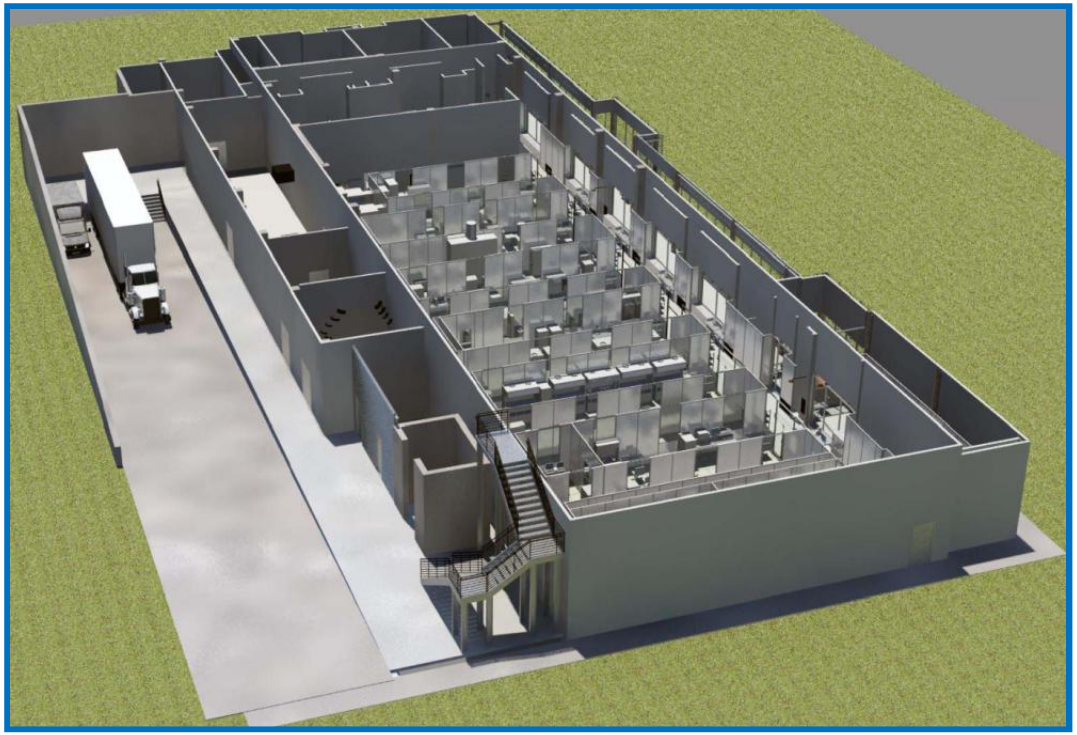
- USTAR Nanofabrication Facilities
- New USTAR Building scheduled for completion December 2011
- Individual PI Lab Facilities
- USTAR instrumentation specific to the MRSEC

  ($6.5 M Commitment)

James L. Sorenson Molecular Biotechnology Building

"Enabling next generation collaborative research on the interface between health care, engineering and sciences for on- and off campus users"

- **~18,000 sq.ft. Bays + Chases**
- **Class 10k/1,000/100 spaces**
- **micro, nano and bio facilities**
- **Microscopy "Core"**
- **Bays for industrial partners**



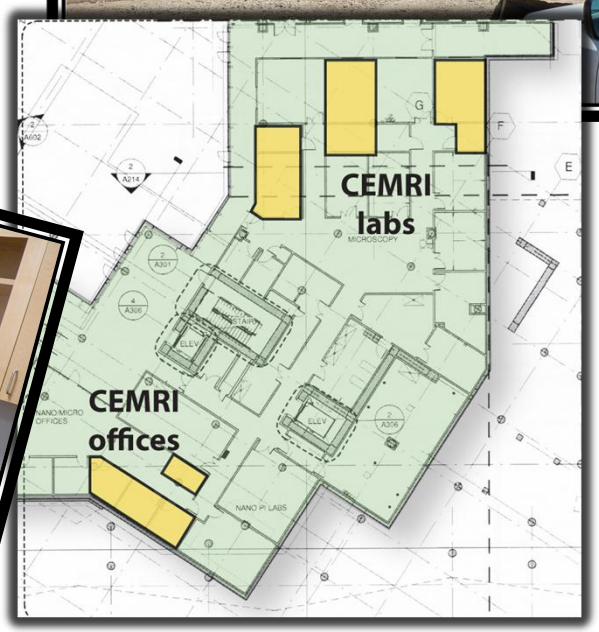
USTAR Equipment Specific to Utah's MRSEC

$6.5 M USTAR Commitment

- Helios UHR dbFIB
- TEM, HAADF, EELS, EDS
- XRD
- TEM Sample Prep
- SQUID
- ESR
- Femtosecond Laser System
- Pulsed high-field ODMR/EDMR spectrometer
- Broadband NMR spectrometer
- UV Microscopes
- Additional Equipment for New Hires
- Installation Costs

USTAR Innovation Center

- New USTAR Innovation Center – Scheduled Completion December 2011
- 214,078 ft^2
- State of Utah Investment of **$156 million**
- **~5,000 ft^2 Microscopy core houses the MRSEC major shared instrumentation**

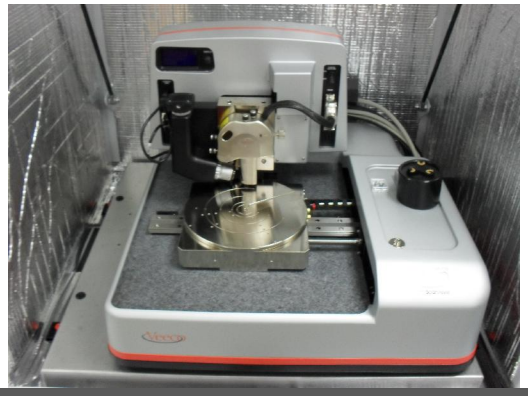


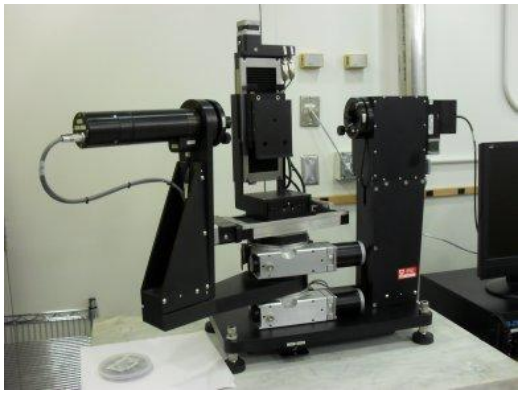
Nano Imaging Core

Dr. Loren Rieth

Dr. Brian Van Devener

Dr. Randy Polson





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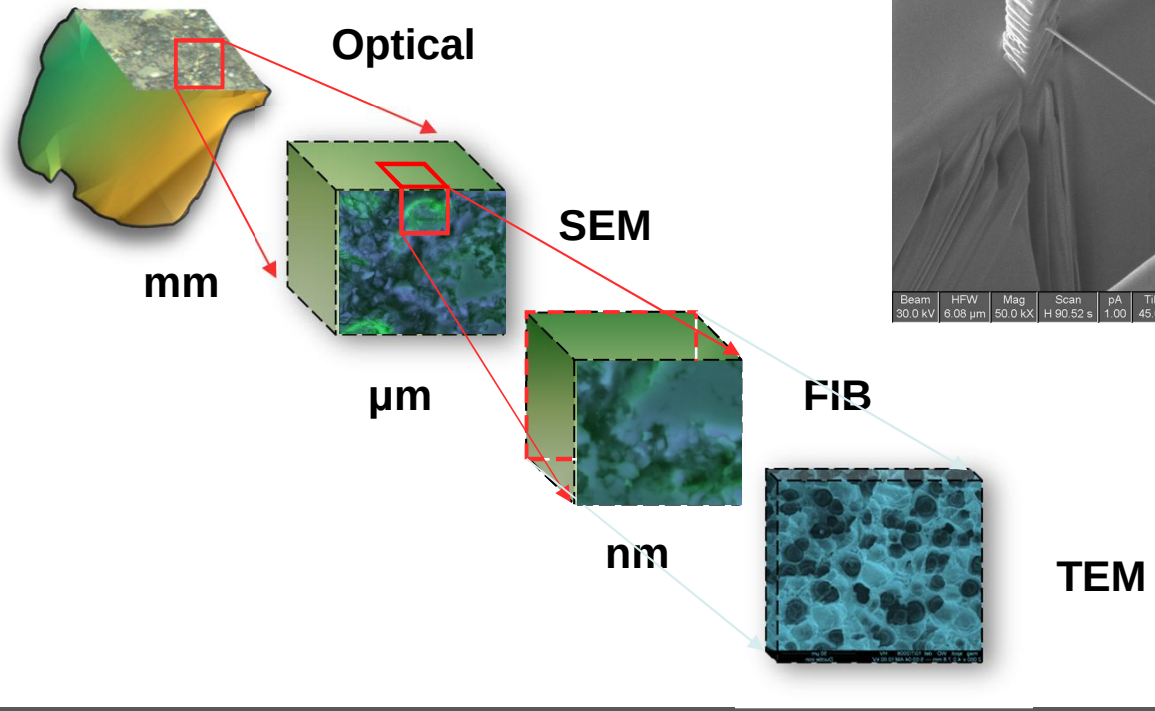
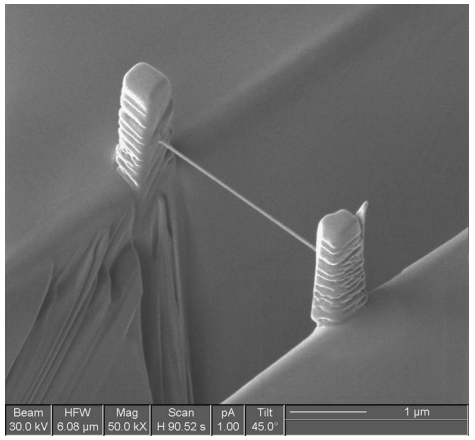
Latest Acquisition: Dual Beam FIB

- Coming in December 2011: New FEI Helios Nanolab 650is dbFIB.
  - Ultra high resolution 3D micro imaging capability
  - Installation date: December 13, 2011 in SMBB
  - Slice-n-view: reconstruct 2D slices into 3D image through depth of samples
  - Deposit Pt in pre-defined patterns
  - Mill patterns using the FIB as a precision scalpel
  - Create precision cross-sections for in-situ viewing

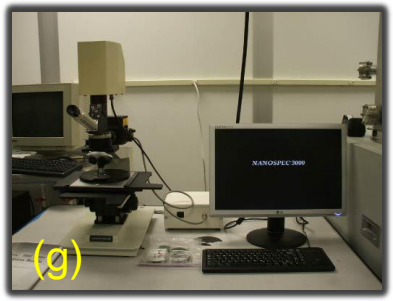




Nanofab Equipment: the usual suspects

http://fab.eng.utah.edu/MicrofabricationEquipment

- TMV SS-40C-IV 6-Cathode Sputt
- Denton DV-SJ E-gun Evaporator
- Oxford 100 ICP/PECVD
- Cambridge ALD Fiji F200
- Electronic Visions EVG420/520
- Spinners, ovens, wet benches
- Nanometrics Nanospec 3000
- STS DRIE
- Micromaster/Optec Laser
- Heidelberg uPG
- Expertech LPCVD
- FEI Nova Nano with Nabity EBL



Recharge Model

- **At Utah, recharge center services:**
  - nanofab + microscopy core
  - Also “affiliated labs” (Private PI labs)
  - 3-day turn on lab user fee seed funds (VP-R & COE funds)
- **Questions:**
  - Distributed administration models:

    distributed personnel vs. distributed inst.

Equipment Maintenance

- **At Utah, moving from**

  “just keep it running”

  to

  “create a working, characterized process”

- **Questions:**
  - Are there ever enough maintenance techs? Process Engineers?
  - Will PI’s let staff engage in “making research more effective”?

Training Users

- **At Utah:**
  - Annual required user training (pizza provided)
  - Short non-credit courses (SEM, DOE)
  - Formal (credit) in-fab courses (4-5 per semester including Freshman)
  - Videos / on-line
  - One-on-one training
- **Question**
  - **What effective disciplinary measures for selfish researchers who disregard policies?**

Logging/tracking/billing

- **At Utah we have Ryan Taylor, and**
  - Open Coral (thanks to “Coach” John Shott at Stanford)
  - Custom (off the shelf parts) interlock boxes
  - Mobile apps for users to see up/down and reserve tools
  - e-mail sent to process owner to verify logged parameters
  - Facilitating “Buddy System” with tools
- **Questions:**
  - Other ideas for facilitating the “buddy system”?
  - What metrics do others find valuable?

Working with outside users

- **At Utah:**
  - USTAR funding based on the premise of tech-based economic development
  - The building is a state building, intended to promote translation of ideas and industrial collaborations
  - Same with state-purchased instrumentation…
  - We know who our customers are
- **Question: How to deal with this biggie:**
  - Customs duties imposed on any imported tool, for “ANY use for which the primary beneficiary is a for-profit entity”

Remote instrument operation

- **In our new building:**
  - Local/regional industries view the U of U as the “microscopy leader”
  - Planned collaborations with nearby UVU, SLCC require distance learning capabilities
- **Questions:**
  - Have others successfully taught classes using remote operation in the classroom (e.g., to teach the operating system)?
  - How have others incorporated distance learning with this?
  - How have others implemented SEM operator/technician training?
  - How to best manage need for “hands-on” time?

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Thank You for hosting us!

Questions?

www.nanofab.utah.edu

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