Institute of Advanced Materials & Technology (*i*-AMT)

Director: Alex Jen

The University of Washington

http://depts.washington.edu/iamat/

Founded 2006

Vision

To discover, design and develop

advanced materials to benefit society

Mission

- To work at the intellectual frontiers, and to achieve excellence, in materials research
- To create synergy between researchers working in all areas of materials research on campus
- To enhance UW materials research through active integration of fundamental research and technology transfer
- To nurture entrepreneurial aspirations of researchers and encourage them to be imaginative in translating discoveries into products for the marketplace.
- To serve as a broker between the academic and business community to convert research discoveries to practical commercial products.

Governance

Scientific Advisory Board

Director: Alex Jen
Assoc. Director: Dan Schwartz
Asst. Director: Hanson Fong

IP Advisory Board

Scientific Thrusts

Energy
Sam Jenekhe*
Guozhong Cao**

Photonics and Optoelectronics
Larry Dalton*
David Ginger**

Biomaterials and Bionanotechnology
Buddy Ratner*

Multifunctional Composites
Mark Tuttle*
Raj Bordia*
Kuen Lin**

Executive Committee

* Thrust Leaders; ** Associate Thrust Leaders

Intellectual Property Advisory Board

Rick LeFaivre (OVP Ventures Partners)

Graham Mott (Global Brand Innovation & Business Creation; Philips Oral Healthcare)

John Reagh (Washington Research Foundation)

George Renzoni (Christianson, O'Conner, Johnson & Kindness)

Keith Ritala (College of Engineering & i-AMT, UW)

Rad Roberts (College of Arts & Science, UW)

Fiona Wills (UW Tech Transfer)

Goals & Strategies

Research

- Take Leadership in Judiciously Selected Research Areas
- Establish Interdisciplinary Research Facilities
- Promote Interdisciplinary Research Activities
- Establish UW as a National Leader in Materials Research
- Generate Licensable Technologies

Translation

- Identify Technologies Ready for Commercialization
- Facilitate the Transition from Discovery to Commercialization
- Promote Industrial Partnerships
- Successful Licenses and Starts-up Companies from Discoveries Made in *i*-AMT

Research Strategies

Establish Leadership in Judiciously Chosen Research Areas

Research Thrusts:

1. Photonics/Optoelectronics
2. Biomaterials and Bionanotechnology
3. Energy
4. Multifunctional Composites

- Matching funds & Proposal Endorsements
- i-AMT led research grants in these Thrust areas e.g. NSF-IGERT on Bio-Energy; DOE-Solar America Initiative

Establish Interdisciplinary Research Facilities

12,000 ft² of research space in Benjamin Hall building:

1. Interdisciplinary Research Labs
2. Shared Instrumentation Facilities

Space will be ready by end of 2008

Promote Interdisciplinary Research Activities

- **Sponsor activities to promote interdisciplinary research & education:**

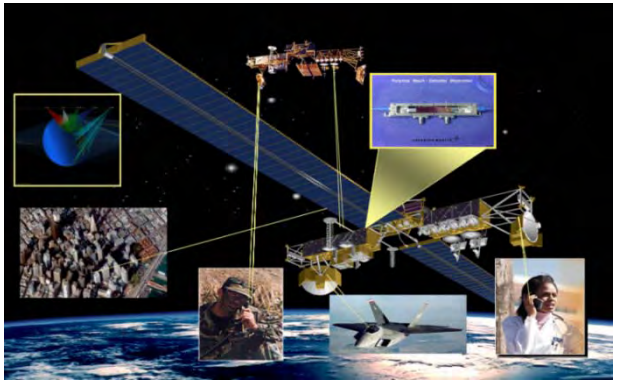
1. Nanophotonics for Breakfast Seminar Series
2. Intensive Courses in NanoScience and Nanotechnology @ PNNL
3. i-AMT Distinguished Seminar Series
4. Energy & Environment Seminar Series

- **Leverage hiring of key faculty in COE and A&S**

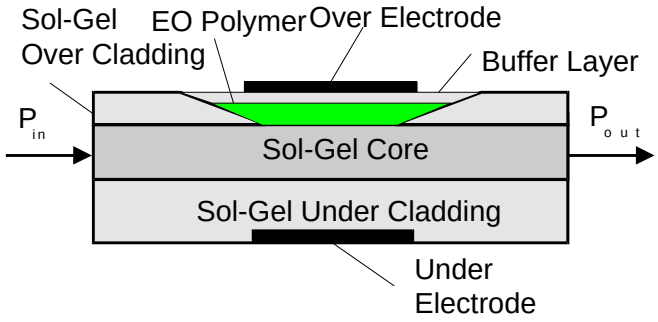
Photonics/Optoelectronic Materials & Devices

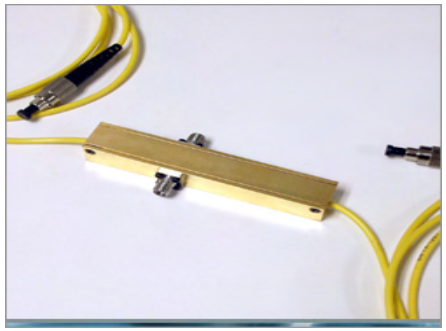
- Develop transformative materials and devices for next generation information technology and sensing.

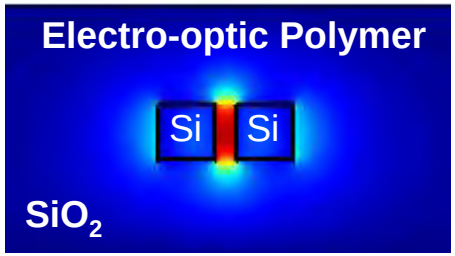
- Current Industrial Partners: Boeing, Corning, Intel, IPITEK, DuPont, Lockheed-Martin, Lumera/Cisco, TIPD, MicroCoating Technologies, Hughes-Raytheon, Nitto Denko Technical, Photonics Systems, OMEGA, Photon-X



Courtesy of Lockheed Martin







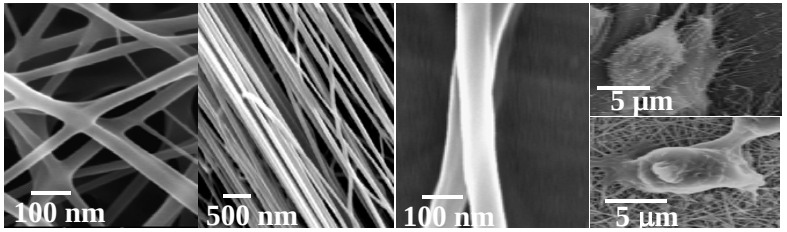
Hybrid Polymer/Silicon Photonics

Courtesy of M. Lipson

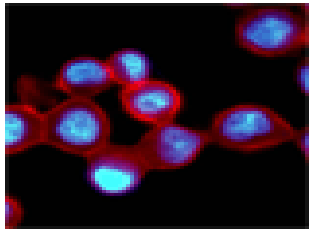
Achieved unprecedented low drive voltage in high-speed E-O modulator devices using UW E-O polymers

Biomaterials & Bionanotechnology

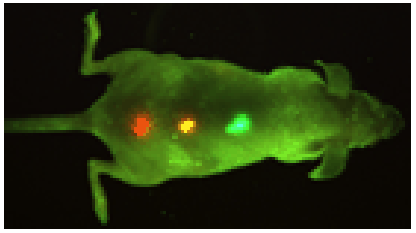
UWEB (A NSF-funded ERC): Nanostructured scaffolds for tissue engineering



Natural polymer nanofibers for tissue engineering (Courtesy of M Zhang)



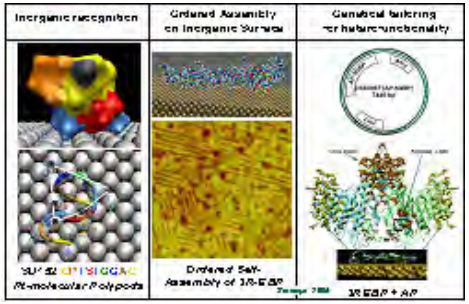
In situ molecular imaging (courtesy of X Gao)



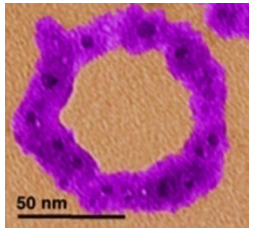
In vivo detection of tumors (courtesy of X Gao)

Multifunctional nanoparticles for applications in imaging/sensing and drug delivery

GEMSEC (A NSF-funded MRSEC): Genetically engineered peptides to fabricate materials with better biocompatibility



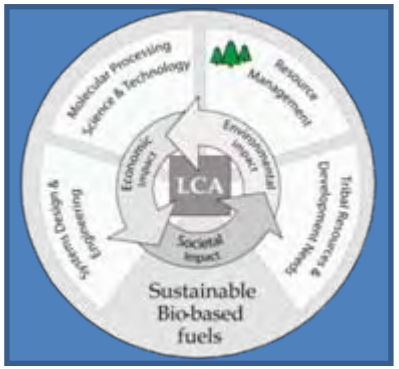
Molecular recognition of inorganic materials (Courtesy of M Sarikaya)



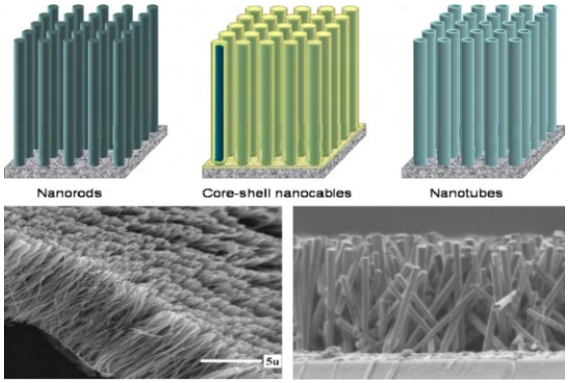
Particles consisting of a Cu_2O core surrounded by a protein shell self-organize on circular DNA (Courtesy of D Schwartz)

Energy

To develop alternative energy technologies with long-term sustainability and minimum environmental impact

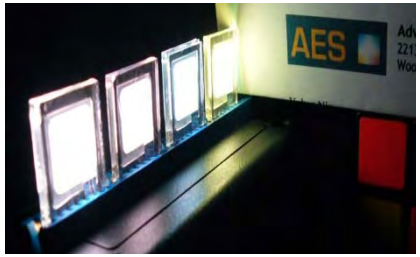


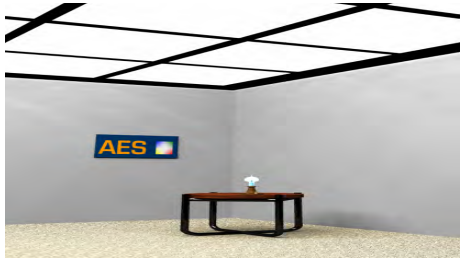
Newly funded NSF IGERT on Bio-Energy
(Courtesy of D Schwartz)



Well-defined nano-porous structures for applications in fuel cells /batteries/capacitors (Courtesy of G Cao)

Large area solar cells for renewable energy





A solid state lighting company based on UW technology (Courtesy of AES)

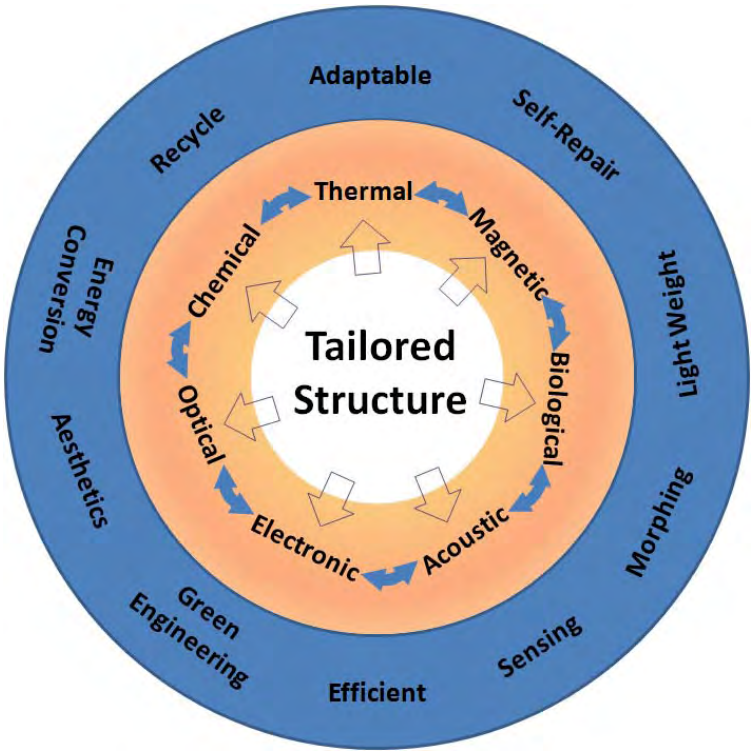
High efficiency solid state lighting by organic LEDs

Next Generation PV Cells Research at UW

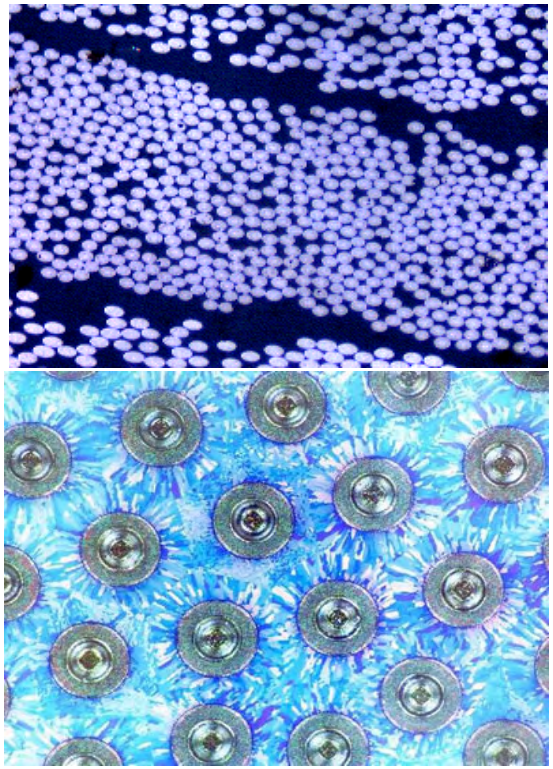
- >$4M current research funding
- >$1.5M in facilities/equipment from DoD, Murdock Foundation, and Intel for organic PV
- DOE BES: $900,000 (07-10) (Jenekhe, Cao, Ginger)
- DOE Solar America Initiative: $900,000 (08-11) (Jen, Luscombe, Rehr, Ginger, Ma)
- NSF Center for Materials and Devices for Information Technology ($40 M/10 yrs)
- Multiple single PI NSF Grants
- Currently is competing for DOE's Frontier Energy Center (~$4 – 5M/yr funding)

Multifunctional Composites

To develop multifunctional composites beyond the traditional structural applications–tailored material properties for specific performances/functions



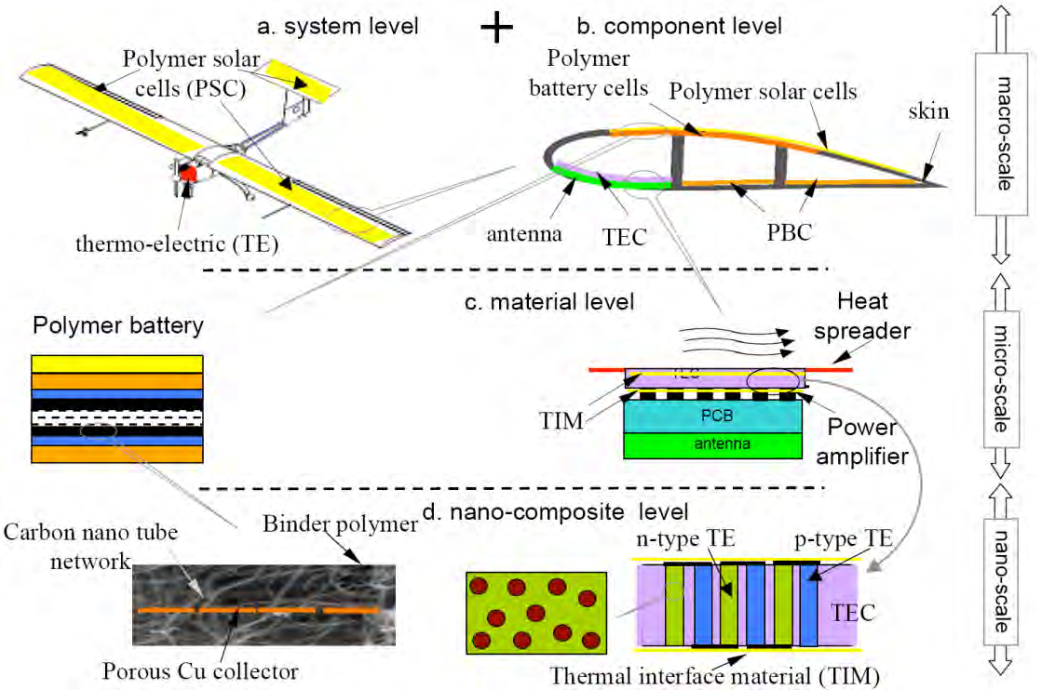
Smart Multifunctional Composite Design (Courtesy of R. Bordia)



Advanced fiber reinforced composite (Courtesy of K Lin & B Flinn)

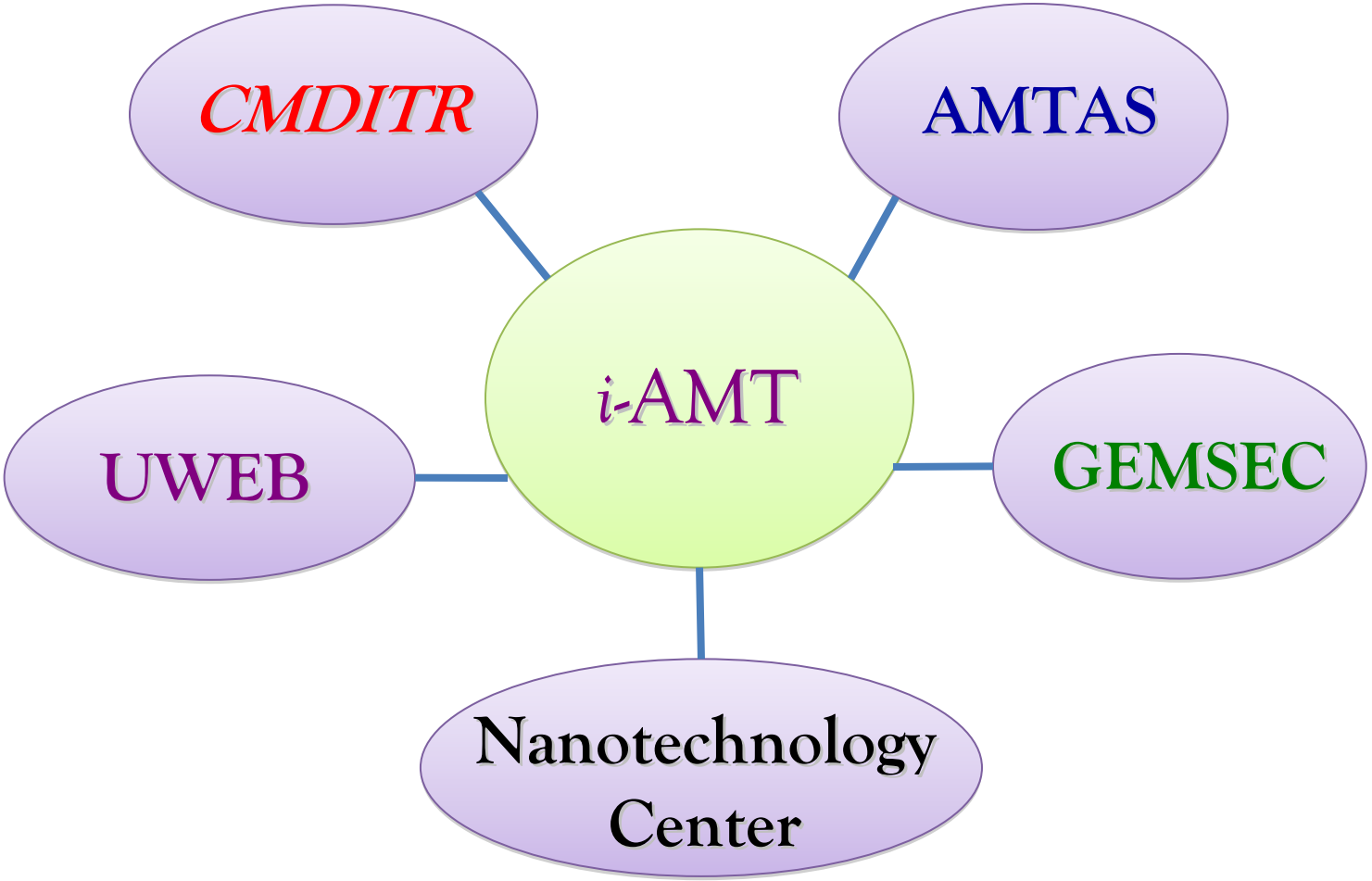
Multifunctional Composites: Green Aviation

- Design aircraft with lighter weight, and lower operating cost, noise, nitrous oxide emissions, fuel burn rate.
- Include environmental constraints at early design stage.
- Multi-criteria Design Optimization (MDO) problem needs powerful optimization algorithms and simulation software that uses finite element analysis.
- "Silent aircraft" (Cambridge-MIT)



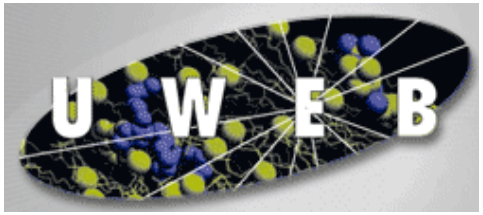
Green Aviation (Courtesy of M Tuttle)

i-AMT Partners: Complementary Strengths



CMDITR: Center for Materials & Devices for Information Technology Research (L. Dalton)

- NSF Science and Technology Center (STC), UW is the lead institution, which includes Georgia Tech, Arizona, Caltech, Maryland, Cornell, Central Florida, Norfolk State University
- Develop *transformative* photonic and electronic materials and devices based on molecular (organic) building blocks
- First five year phase: 18MM, second five years 20MM (07-12)
- CMDITR involves over 300 students, faculty, post docs and staff
- CMDITR is one of eleven STC's across the US
- Faculty from Chemistry, Physics, Optical Sciences, Materials Science & Engineering, Mechanical Engineering, Electrical Engineering, Applied Physics Laboratory, Chemical Engineering



UWEB: UW Engineered Biomaterials (B. Ratner)

- NSF, Engineering Research Center (ERC)
- "Biomaterials that Heal"
- Eleven years (1996-2007), 35MM plus (total costs)
- Cross-disciplinary team of materials scientists, molecular biologists, biomolecular engineers, biomaterials researchers, bioengineers and physicians, as well as industry leaders in the biomaterials field.
- Three-way partnership involving academe, industry, and NSF
- 20 companies, 100 students, 25 Faculty, 20 technical staff

THE CENTER FOR NANOTECHNOLOGY AT THE UNIVERSITY OF WASHINGTON

Center for Nanotechnology (F. Baneyx)

- Established through the UW's University Initiatives Fund (1997)
- Nanotech User Facility (NTUF) advanced characterization and fabrication instruments and equipment; one of 13 in the National Nanotechnology Infrastructure Network (NNIN)
- Research focus on producing nano safe products
- 75 faculty from Chemistry, Physics, BioEngineering, Chemical Engineering, Electrical Engineering, Materials Science and Engineering, Biochemistry, Genome Sciences, Physiology, Biophysics, Microbiology

A Center of Excellence
AMTAS
Advanced Materials in Transport Aircraft Structures

AMTAS: Advanced Materials in Aircraft Structures (M. Tuttle)

- Federal Aviation Administration Center of Excellence (2003), UW lead institution
- 10 years, 1.5-2 MM/yr (FAA & 1:1 matching from non-federal sources)
- Consortium of academic institutions, aerospace companies, and government agencies
- Address safety and certification initiatives for existing, near- and long-term applications of composites and advanced materials for large transport commercial aircraft
- 3 academic institutions, 12 industry partners

GEMSEC: Genetically Engineered Materials Science & Engineering Center (M. Sarikaya)

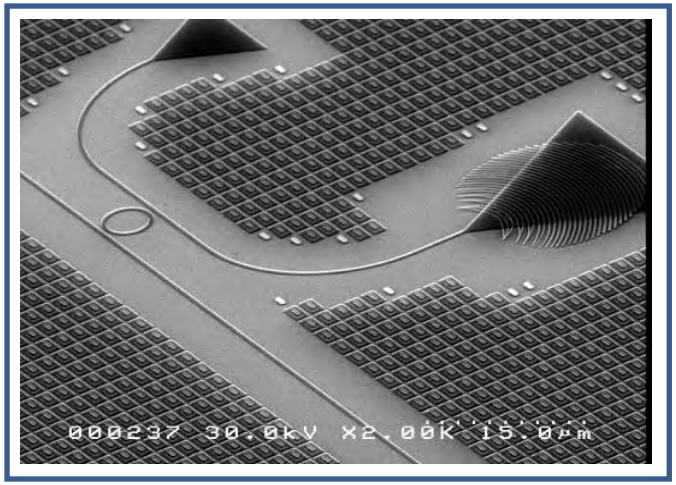
- NSF grant (2005)
- Six years, 7.7MM (UW matching)
- Research to adapt and develop molecular biology and genetics protocols to engineer peptides and proteins
- Marry the science and technology of the two fields, biology and materials sciences and engineering
- Develop and establish Shared Experimental Facilities for interdisciplinary research
- 11 Faculty, 3 industry partners

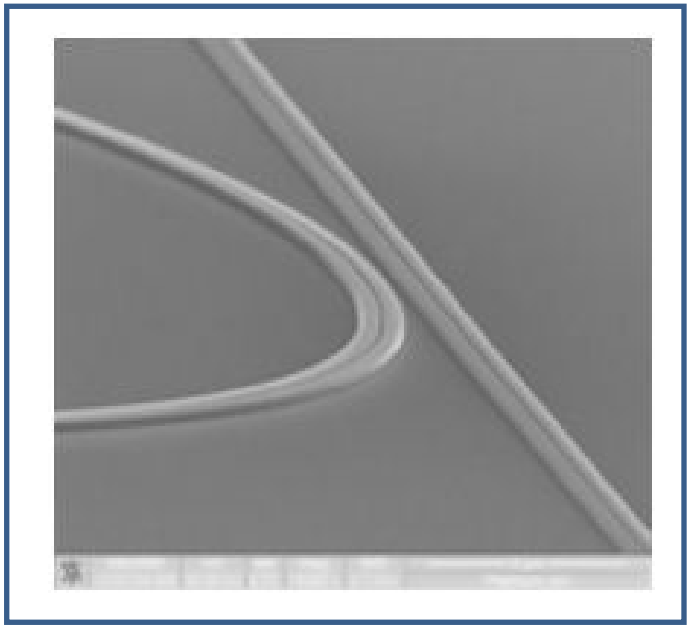
Shared Instrumentation Facilities (SIF) (M. Hochberg)

- Integrate functions of existing and new facilities to provide strong capabilities in gaining fundamental understanding and cutting-edge devices, subsystems, and applications for translational research.
- Develop sustainable user-fee based facilities to provide well maintained and state-of-the-art instruments.
- Establish partnership with WTC, Nanotech User Facilities (NTUF) and the new Institute of Molecular Engineering at UW.

Shared Instrumentation Facilities (SIF)

SIF 1. Shared Optoelectronic Device Test Facility to provide testing capabilities for nanoscale Si and hybrid photonic devices (The proposal is being evaluated by the Murdock Foundation)



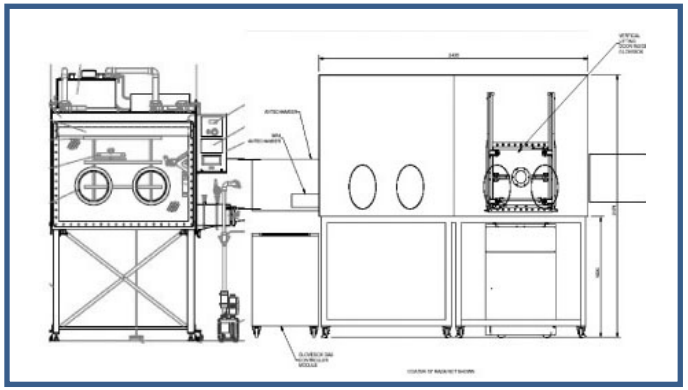


Images show integrated silicon devices from Luxtera with couplers, fabricated in a commercial foundry by Luxtera Corp. (Courtesy of Luxtera)

SIF 2. High Throughput Electron Beam Lithography Facility for fabricating nanostructures with high reproducibility over large areas at high speed ($2.5 M NSF MRI proposal with $1.2M matching from Washington State EDC)

Shared Instrumentation Facilities (SIF)

SIF 3. Inert Atmosphere System for Fabrication and Characterization of Thin-Film Organic Electronics and Photonics (obtained $1M from DoD DURIP & Murdock Foundation)



SIF 4. Multi-user Facility for Synthetic Scale up and Purification in Benjamin Hall Building

Institute Facilities and Space

- 12,000 ft^2 of space in Benjamin Hall Building
  - Dedicated and shared space for translational research
  - Space for state-of-the-art laboratories for interdisciplinary research
  - Space for Shared Instrumentation Facilities
  - Space for offices and a conference room

- 6,000 ft^2 of newly renovated wet chemistry labs in Bagley Hall

- DURIP and Murdock Charity grants for organic electronic fabrication and testing drybox; cryogenic facility

Translational Strategies

Promote Industrial Partnerships and Collaborations:

- Partnerships with Intel, Boeing, Micron, Lumera and other industrial companies in the NW region
- Promote research capabilities & discoveries through active marketing

Identify Technologies Ready for Commercialization:

- IP Advisory Board review of selected discoveries
  - Commercial potential
  - Applications & Markets
  - Patent strategy
  - Links to licensees & research partners
- Work with inventors to facilitate patenting & commercialization

Facilitate the Transition from Discovery to Commercialization:

- ~3000 ft² of industrial lab suites, shared instrument facilities, & office space to support translational research
- Identify critical market needs in thrust areas & develop research programs to address

Toward functioning as an incubator for UW inventors!

Initial Industrial Partnerships

Intel - UW research partnership in high-efficiency solar energy high-speed EO modulation research

Boeing – UW partnership to develop materials and devices to next generation aviation needs

LUMERA

Build on established Lumera – UW partnership to expand into new electro-optic and protein array technology

Possible Models for i-AMT

Model	Pros	Cons
Consortium	• Membership fees are unrestricted • Wide range of potential member cos.	• Dilution of exclusive licensing opportunities • Fees may prohibit small companies from joining
Federally-supported Research Center (e.g., I/UCRC, STC, DOE Frontier Energy Center)	• Leverage industry research funding to attract federal $$ • Validates mission	• Highly competitive review process • Unlikely to cover entire range of technologies
Incubator	• Provides a platform for spin-off & start-ups • Strong need exists in Seattle area	• May need to operate separately from UW • Start-up funding req'd. until self-sustaining

Next Steps

- Form Scientific Advisory Board
- Identify and pursue potential funding sources
- Establish policies for handling confidential & proprietary information
- Host 'Open House' workshop to link researchers with industry