



Louisiana Materials and Emerging Technologies Conference

The sixth in a series of Louisiana Annual Conferences, sponsored by the Louisiana Board of Regents and Louisiana Experimental Program to Stimulate Competitive Research, was held on December 12-13, 2005, at the Institute for Micromanufacturing, at Louisiana Tech University.

The focus of this conference was on materials and emerging technologies under research and development in Louisiana. The conference achieved its main objective of bringing together participants from universities, industry, and government agencies in Louisiana and the nation. It provided an effective means of communication and networking among the participants, leading to the development of collaborative efforts and initiatives benefiting Louisiana and the nation. Due to hurricanes Katrina and Rita having a severe impact on Louisiana, the conference also emphasized the post Katrina and Rita challenges and opportunities facing Louisiana.

The conference was well attended, with over 160 participants from Louisiana and the nation. The invited speakers and the topics of their presentations were:

- **Dr. Michael Khonsari** (Louisiana Board of Regents), "The Impact of Katrina and Rita on Louisiana's Research and Education Enterprise"
- **Dr. Kevin Lyons** (National Science Foundation), "Nanomanufacturing: Fulfilling the promise of Nanotechnology"

- **Dr. Charles O'Connor** (University of New Orleans), "The Advanced Materials Research Institute at the University of New Orleans: Current Research Programs and the consequence of Katrina"
- **Dr. Blake Simmons** (Sandia National Laboratories), "Advanced Sensors and Devices for the Monitoring and Detection of Water Supply Contaminants"

This year, the first annual recognition for outstanding research contributions of a Louisiana researcher was also awarded by the conference. This award went to Dr. Charles J. O'Connor, Distinguished Professor of Chemistry, at the University of New Orleans, and Director of the Advanced Materials Research Institute (AMRI).



Dr. Charles O'Connor being presented by Dr. Michael Khonsari the 1st Annual Award for Outstanding Louisiana Researcher.

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Special points of interest:

- Nanotechnology
- Biotechnology
- Biomedical Nanotechnology
- Environmental Technology
- Information Technology

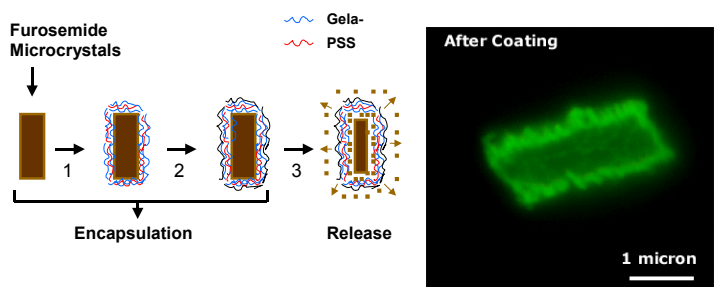
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Comments are welcomed!



IfM Industrial Contracts and Commercialization Initiatives

A connection between pure research and its application in industry is of utmost importance. The realization of research projects leading to commercial applications is central to the mission and vision of the IfM. The Institute researchers are actively engaged in the realization of commercially viable technologies that contribute to the economic development of Louisiana and the nation. This is also manifested in the increasing number of industrial contracts received by the IfM in recent years for the development of novel technologies that combine IfM's innovative micro and nanotechnology research findings. Examples of recent industrially-sponsored projects and their associated main investigators are as follows: Y. Lvov, "Eye Lens Nanocoating for Specific Hormone Adsorption," Novartis Corporation; P. Coane, "MEMS Advanced Processing," Space Photonics Incorporated, and OmniPak, LLC; J. Fang and K. Varahramyan, "Variable Focus Microlens Technology," HoloChip Corporation; Y. Lvov, "Nanoengineered Protein Drug Encapsulation," Baxter Corporation; D. Kuila, "Investigation of Micromixing and Precipitation Kinetics of Organic Bases," Pfizer Corporation; Y. Lvov, "Nanoassembly for Pulp and Paper Processing," SAPPI Fine Paper Corporation. Additional contracts are expected to be signed soon for projects developed by M. McShane, F. Ji, and K. Varahramyan. Over the past several months, IfM researchers have attracted over 0.7 million dollars in industrial contracts and by this spring, new contracts are expected to exceed the one million dollar mark. Highlights of some of the industrially-sponsored projects are provided below.

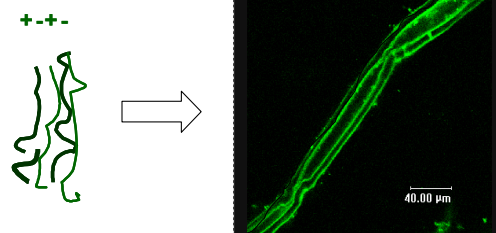


Protein Drug Encapsulation

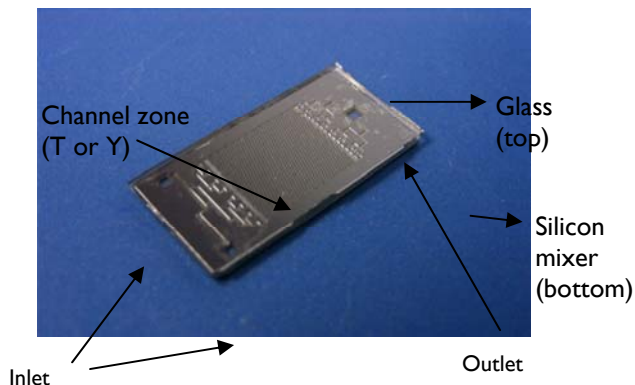
Nanoengineered Protein Drug Encapsulation: The overall objective of this work is the production and application of nanocapsules with targeted controlled release properties of chemicals. For this, new types of nanoparticles are being developed and used as core vectors for active medical molecules. Nano-engineered ultrathin layer assembly is performed to build a capsule shell of predetermined composition, designed for special release properties, around the drug microcrystals. Simply said, IfM researchers are designing minute (<1/1000 millimeter) "submarines" which will carry drug molecules and deliver them to sick cells, easily passing through narrow blood vessels due to their minute dimensions.

Nanoassembly for Pulp and Paper Processing: Systematic modification of softwood pulp fiber surfaces is under development with the layer-by-layer (LbL) nano-assembly approach via alternate adsorption of positive and negative polyelectrolytes. Fiber surface and lumen are coated with polyelectrolyte films of 10 nm to 50 nm, depending on molecular composition. The deposited LbL nano-layers enhance the fiber surface properties for improved papermaking.

LbL-Nanocoating



Pulp and Paper Processing



A Micro-mixer for Precipitation Study of Drugs.

Micromixing Studies on Drug Precipitation: The solubility of drugs in the gastrointestinal tract can be affected by several factors, including pH of gastrointestinal fluid, surface tension, buffer capacity, mixing, and the physicochemical properties of the compound itself. To avoid precipitation of drugs, when it is being transferred from stomach to intestine, mixing effect on solubility of drugs during change of pH, is required to study precipitation kinetics. The goal of this work is the development of a micromixer for precipitation kinetics studies.



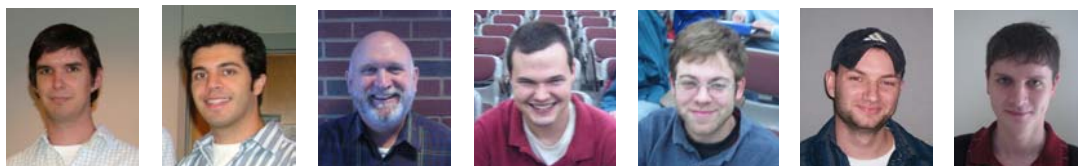
MSE 501 Poster Presentations

On November 17, 2005, students from Dr. Chester Wilson's MSE 501 Microsystems Principles course presented posters for their class projects. This course is one of the core courses for graduate studies in the micro/nanosystems area at Louisiana Tech University. Each student was required to do an independent project, and present the re-

sults via a poster and a corresponding written report. The course project was to select a recent paper on a device reported in the Journal of Microelectromechanical Systems, to understand it, implement a design change to improve the device, and develop and report a new process, and testing approach. Eight judges, consisting of IfM fac-

ulty and staff, were assigned to pick the top 3 posters. Although 3 awards were anticipated, there were several ties. The following are the winners and their research faculty supervisors: Best Undergraduate poster award: John Sweeney and Kamran Varahramyan (Dr. Chester Wilson); Best Graduate Biomedical poster award: Greg Dorion (Dr. Sven Eklund);

Best Graduate Microsystems poster award (tie between): Scott Pellegrin (Dr. Chester Wilson), Chad Whitney (Dr. Pedro Derosa), Joey Cannon (Dr. Sandra Selmic), and Heath Berry (Dr. Chester Wilson).



L-R: John Sweeney, Kamran Varahramyan, Greg Dorion, Scott Pellegrin, Chad Whitney, Joey Cannon, Heath Berry



Dr. Chester Wilson

Recent IfM Grants

Dr. Yuri Lvov

"Layer-by-Layer Nanoassembly for Pulp Fiber Modification," SAPPI Fine Paper Corporation, \$120,000; Jan 2006 - Jan 2007

"Contract Extension, Baxter Corporation, \$100,000", 2 yr total: \$260,000; Aug 2004- Sept 2006,

Dr. Chad O'Neal

"Evaluation of Electroactive Polymers as Strain-gauges for Small Displacements", Army Corps of Engineers, Waterways Experiment Station, \$25,000; Jan 2006 - April 2006

2006 Spring Seminars

Functional Nanoassemblies: Fundamentals and Applications

January 31: "New Ideas in Integrating Nanoscale Self-Assembly with Microlithography", J. S. Mohammed, M. McShane

February 14: "Nanoparticle Coating of Cellulose Microfibers", Z. Lu, G. Grozdits

March 14: "Nanotubule Halloysite: New Fancy Nanocontainer for Drug Loading and Sustained Release", N. Veerabadran, Y. Lvov

March 28: "Electrophoretic Nanoparticle Loading of Cement", H. Cardenas

April 11: "Swell Gels as Rapid Chemo-Optical Transducers: pH and Glucose Sensors", A. Mack, P. Grant, M. McShane

April 25: "Nanoparticles for Cancer Therapy and Imaging", P. O'Neal

May 9: "The LinaS Project: Progress and Perspectives", M. Benford, B. Pettway, E. Stein, H. Zhu, M. McShane,

All Seminars are held on Tuesday's at 2:00 p.m., in the IfM Auditorium 101

Student Awarded Best Paper by IEEE Sensors 2005

Graduating Ph.D student Weisong Wang (Advisors: Senior Research Engineer Ji Fang and Dr. Kody Varahramyan) was awarded first prize for the best student paper at IEEE Sensors 2005 Conference, in Irvine, CA, this past November. Dr. Wang also received \$1000 cash, a certificate, and an engraved glass, desktop award. The 2005 international conference attracted over 500 participants from 48 countries, with 628 papers submitted in the sensor field, from leaders in academia and industry. Dr. Wang presented his winning paper, co-authored by Mr. Fang and Dr. Varahramyan, on "Auto-Tunable Microlens Chip for Sensing Application".



L-R: Ji Fang & Weisong Wang



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and Less Expensive Consumer Products,
Industrial Machines, Instruments...
Possibilities Limited Only by One's Imagination”



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Vision and Mission

The vision of the IfM is to be a world-class resource for the realization of commercially-viable micro- and nano-systems, contributing to the economic infrastructure of Louisiana and the nation and benefiting humanity as a whole.

The mission of the IfM is:

- h To research and develop novel micro and nanosystems for biomedical, biological, environmental, chemical, information technology, and other applications
- h To generate and harness commercially viable intellectual property
- h To partner with industry, government, and academia in economic development

- h To transfer new technology and provide technical training to industry and government
- h To develop curricula and educate students in micro/nano scale technologies and systems

The IfM offers a wide range of microtechnology capabilities for the realization of micro electro mechanical systems (MEMS), as well as a complementary array of nanotechnology capabilities for MEMS and other applications. **Nanotechnology, Biotechnology, Biomedical Nanotechnology, Environmental Technology, and Information Technology** constitute the five major research and development thrust areas and centers of excellence of the IfM.

Examples of projects include:

BioMEMS efforts aimed at the development of select commercially viable micro and nanosystems for biomedical and biological applications; EnviroMEMS efforts aimed at the development of select commercially viable micro and nanosystems for environmental and chemical applications; Nanotechnology efforts directed at the development of select commercially viable nanotechnologies for BioMEMS, EnviroMEMS, and other applications; Information technology efforts are directly supportive of the State of Louisiana IT Initiative and current efforts include projects for the realization of enabling micro/nanotechnologies for information sensing, storage and processing.



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