

Micro/Nano Technology Center Nano News

It's Happening Here

Director's Message

As founding director of the Micro/NanoTechnology Center (MNTC) at the University of Louisville (UofL), I welcome you to its quarterly *NANO NEWS* letter. This is an exciting time for the MNTC having recently moved into a new \$60M interdisciplinary research building in the center of UofL's main campus. Our signature core facility is an AGI-designed 10,000 sq. ft. 7-bay cleanroom for micro/nano teaching, research and commercialization. Our class 100/1000 facility is used by 8 departments and over 100 users. In this brief newsletter, we hope to share with you some of the exciting events happening at the MNTC. Feel free to contact myself or any of our experienced staff to discuss collaborative opportunities. In the spirit of our University's new tag line: *IT'S HAPPENING HERE*. I invite you to join us!

Dr. Kevin M. Walsh (Prof. of ECE)

Commercialization Update

During the last few years, UofL's MNTC has served as the catalyst for several commercialization efforts. OrthoData Technology (OTD) is a startup company developing an implantable sensor and telemetry system for spinal fusion monitoring. UltraTrace Detection (UTD) is commercializing MEMS-based micro-hotplates as preconcentrator assemblies to dramatically enhance sensitivity of explosive detectors. Nauga-Needles is developing custom nano-probes for AFM and biological applications. Assenti is commercializing an implantable system for the eye to monitor intra-ocular pressure for the prevention of glaucoma using MEMS and RFID technologies. Finally, Sentinel is developing a telemetric system for preventing febrile seizures in infants. UofL's MNTC is proud to serve as a resource for all of these exciting ventures and wishes them well as they continue to evolve and change the technological landscape of the city of Louisville. (KMW)

17th Biennial IEEE UGIM Symposium

The 17th Biennial IEEE UGIM (University/Industry/Government Micro-nano) Symposium was held in Louisville, Kentucky on July 13-16, 2008. The international conference attracted over 130 attendees from all around the world, making it the second largest UGIM event in conference history. UofL and the MNTC served as the official host for the conference and Prof. Kevin Walsh of the UofL ECE Dept. served as



General Chair. The conference included talks by 4 internationally-renown keynote speakers (Dr. Rajinder Khosla of NSF, Dr. Mark Lundstrom of Purdue, Dr. Stephen Campbell of Minnesota, and Abbie Gregg of AGI), over 40 oral presentations, and over 30 poster presentations by industry, government and university representatives. The papers for UGIM08 were organized into 11 sessions, ranging from research specific topics such as electro-wetting, MEMS, material processing, lab-on-a-chip and microelectronics to infrastructure topics about cleanroom facilities to academic issues involving micro-nano curriculum development. UGIM08 also included organized campus tours of UofL's new \$20M 10,000 sq. ft. class 100 micro/nano cleanroom facility which recently received top 10 recognition in Small Times Magazine. Patrons for UGIM08 included JST, Wright Brothers, KY EPSCoR, Signatone, theUofL Research Office, the IEEE Electron Device Society, and the UofL MNTC. For a copy of the conference proceedings, please contact Wendy Metcalf of the UofL MNTC. (KMW)

MNTC part of Largest NSF Award in State

On October 27, 2008 Kentucky Governor Steve Beshear announced the state's largest NSF award to date and UofL's MNTC is proud to be a vital participant. The \$12.5M NSF award will fund high-tech research at Kentucky universities in the areas of nanotechnology, biotechnology and cyber-technologies. The five-year award made through Kentucky's Program to Stimulate Competitive Research (EPSCoR) will be matched with an additional \$5M from the Commonwealth over the life of the grant. "This grant furthers my administration's goal on quality education for our children," said Gov. Beshear. "We must broaden opportunities for students to stretch their minds and provide the necessary tools for them to learn, conduct research and develop innovative concepts that will, ultimately, improve Kentucky's ability to compete in a 21st century economy." Several universities will be involved in the research efforts. The major recipients are the University of Louisville and the University of Kentucky. Other institutions include Kentucky State University, Northern Kentucky University, Eastern Kentucky University, Centre College, Berea College and Morehead State University. (KMW and Jay Blanton)



MNTC Helps Louisville Fire Department with HazMat Drill

On Tuesday, October 14 2008 UofL's MNTC and the Department of Environmental Health and Safety in conjunction with the Louisville Fire Department and Department of Homeland Security conducted a simulated hazardous spill in the Belknap Research Building Cleanroom (MNTC) on UofL's Belknap Campus. Six fire companies including the city's four hazardous materials unit responded. The simulated spill was a chlorine tank explosion with four people unaccounted for. None of the firefighters who responded knew what the scenario would be ahead of time. The drill was a rare chance for the University emergency responders to practice along side the fire department how each would respond in the event of a hazardous spill. The exercise had been in the planning stage for two months and was led by Capt. Jody Maeiman of Louisville Fire and Rescue. Mark Crain, Manager of the UofL MNTC and Don Yeager, Technical Research Coordinator for the MNTC were also involved in the planning and implementing of the drill. The drill was covered by the local television stations and newspaper. (KMW and Dennis Sullivan)



Our Services Include:

Thin Film Deposition

Evaporation: Thermal and e-beam assisted evaporation of Cr, Au, ITO and many other materials on up to 6-in. substrates.

Sputtering: RF & DC magnetron sputtering on a variety of substrates: Cr, Au, Ti, W, TiW, Pt, YBCO, ITO and many others.

Parylene Coating: Vapor Deposition of Parylene C and Parylene N. Parylene deposition provides the capability to conformally coat dielectric and biocompatible layers on fabricated devices.

Molecular Vapor Deposition: Deposition of organic surface coatings used as lubricants, antistiction layers, molecular glues or reactive adhesion layers.

Electroplating: MEMS processing for Cr, Au, Cu and Ni using the IKO electroplating system.

Thermal Processing

Oxidation and Diffusion: Thermal processes include wet and dry oxidation and boron and phosphorous diffusion.

Rapid Thermal Processes (RTP): For silicon-based gate oxide growth and rapid thermal annealing.

PECVD: For depositing nitrides and oxides.

Lithography

Photomasks: 4-, 5- and 6-in. masks with linewidths down to 1.0 micron produced with the Hiedelberg DWL66 laser pattern generator.

Contact Lithography: For individual dies to whole 6-in. wafers. Our Suss MA6 and AB-M mask aligners also provide back-to-front alignment capabilities. Nanometer resolution e-beam lithography also available.

Maskless Lithography: Intelligent Micro-Patterning SF-100 provides 5 μm linewidth lithography with direct imaging using a DMD.

Etching and Machining

Deep Reactive Ion Etch (Silicon): Silicon DRIE using the Bosch process. Our STS DRIE has pulsed platen bias to minimize "footing" at oxide etch stops.

Plasma Etching: RIE systems are capable of providing selective silicon, SiO₂ and Si₃N₄ etches as well as ashing processes.

Xenon Difluoride Etching: Dry anisotropic silicon etching using the Xactix XeF₂ etching system allows for efficient etching of silicon microstructures prone to stiction.

Anisotropic Silicon Wet Etching: Extensive experience with KOH, TMAH and EDP wet etchants.

MicroMilling: Dover Instruments Ultra-High-Precision Micro Milling Machine is a CNC milling station with nanometer spatial resolution for machining virtually any solid material (i.e., metals, polymers, ceramics, etc.)

Wafer Level Bonding: Suss MicroTec SB6 for Si/glass anodic bonding, glass/glass thermal compression bonding and Si/Si fusion bonding.

Miscellaneous: Nano-imprinting, micromolding, chemical mechanical polishing, ultrasonic drilling, etc.

Packaging

Dicing: Automated Disco Dicing Saw for silicon, glass and alternative substrate dicing.

Wire Bonding: K&S wedge, ball and deep access bonders for aluminum and gold 1-mil wire bonding.

Flip Chip Packaging: Finetech Fineplacer "pico" system for die placement up to 5 μm . Can handle SMCs up to 17-mm side length.

Printed Circuit Boards: An automated milling system for custom PCB production.

Lapping and Polishing: Lapmaster system is capable of thinning a variety of substrates as well as final polishing.



The University of Louisville Micro/NanoTechnology Center (MNTC) provides state-of-the-art fabrication and design services for numerous MEMS, microelectronic, electro-optic and nanotechnology applications. Services begin at the device design level and continue through single-step processing, complete device prototyping and small-scale production. The center encompasses core facilities for micro/nano fabrication, packaging, metrology & test, including a 10,000 sq. ft., 7-bay, class 100/1000 cleanroom. Our wide variety of micro/nano processing tools and 10-plus years of operating experience make our AGI-designed facility popular not only with researchers at UofL and other universities throughout the Ohio Valley region, but with industry and government laboratories nationwide, too. Several multi-million dollar grants from federal agencies support the research carried out in the MNTC including grants from NSF, NIH, DOD, DOE, NASA, and industry. The MNTC is housed in a 120,000 sq. ft. interdisciplinary research building and it allows UofL researchers to use a wide range of equipment and processes to fabricate, package, and test next-generation micro/nano devices and systems. The cleanroom is also a catalyst for start-up businesses and has had a positive impact on the technological economy of the Commonwealth of Kentucky.

For more information on available services contact:

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University of Louisville
**Micro/NanoTechnology
Center**

Innovation Through
Miniaturization



<http://louisville.edu/micronano>