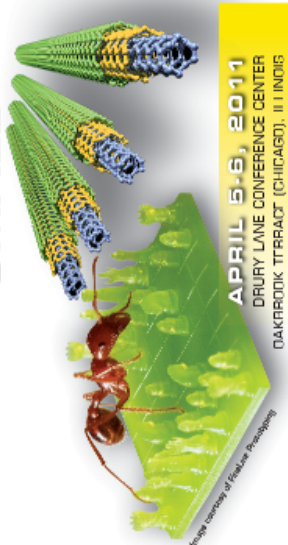




Society of
Manufacturing
Engineers

One SME Drive, P.O. Box 930
Dearborn, MI 48121-0930

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OF THE **SMALL**

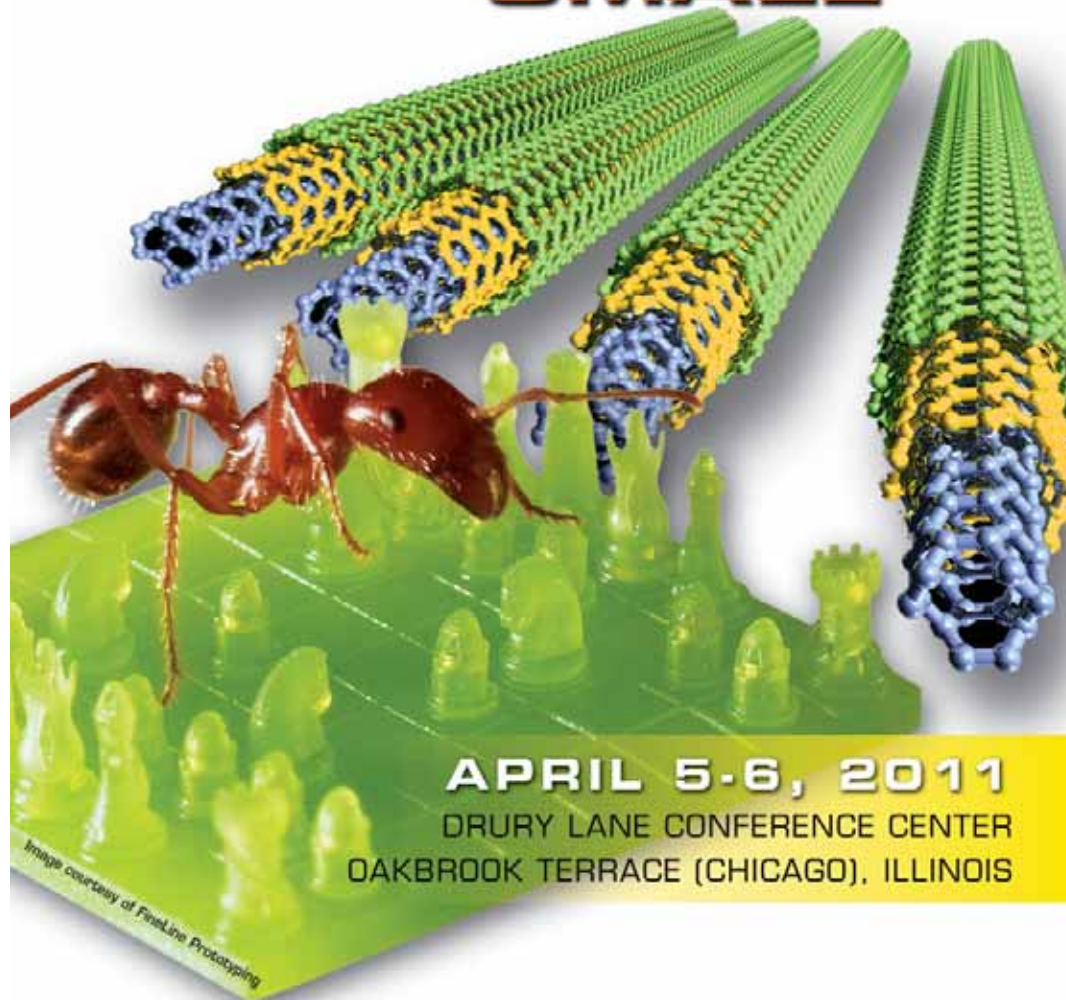


APRIL 5-6, 2011
DRURY LANE CONFERENCE CENTER
OAKBROOK TERRACE (CHICAGO), ILLINOIS

MICRO
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Engineers



EXPLORE THE ENORMITY OF THE SMALL



APRIL 5-6, 2011

DRURY LANE CONFERENCE CENTER
OAKBROOK TERRACE (CHICAGO), ILLINOIS

TWO EVENTS IN ONE

Co-located, the MicroManufacturing and NanoManufacturing Conferences & Exhibits offer you even more opportunities to explore new ideas and meet others working in similar areas. Attend the only events exclusively focused on current and near-term technologies and applications in key areas.

Register for one event and attend any presentation in the other. Both conferences share group lunches, exhibits, reception, keynote presentation, poster session, and special interactive tours.

Join us for two idea-packed, peer-to-peer discussion days!

KEYNOTE: Interesting vs. Innovative

Jon Rambeau

Vice President for Technology Transition, Lockheed Martin



Innovation is the process that translates knowledge into economic value. It encompasses a series of technological, organizational, financial, and commercial activities. As with any technology new to the market, nanotechnology brings unique transition challenges. Rambeau will address the strategy phase of technology development, discuss the best allocation of resources, and examine the qualities of successful transitions.

As a member of Lockheed Martin's Corporate Engineering & Technology organization, Rambeau serves as Vice President for Technology Transition. In this role, he develops and executes plans for transitioning innovations that are initiated and supported through corporate technology investments into the corporation's business units, to support further maturity and business growth objectives.

Rambeau joined Lockheed Martin in 1996 and has held various leadership and management positions in manufacturing operations for the US Navy's Aegis weapons system program, developing corporate-wide procurement strategies and supplier agreements for embedded computing products and power supply systems, Transportation Security Administration's Strategic Airport Security Rollout (SASR) airport security enhancement program, homeland security, and building a biometric credentialing business. He holds a B.S. in mechanical engineering from Drexel University and a M.S. in management of technology from The Wharton School and the University of Pennsylvania's College of Engineering.

POSTER SESSION

April 5, 2011 • 2:00 p.m. – 6:30 p.m.

A select group of poster presentations will be available to view and discuss. You will see some of the best work taking place at both industry and university research centers in micromanufacturing and nanomanufacturing. The poster session is open to all conference and exhibits participants.

EXHIBITS AND NETWORKING RECEPTION

Increase networking opportunities by attending the program's reception on April 5 and mingle with an anticipated audience of 300+ micromanufacturing and nanomanufacturing professionals.

Representatives will be available at the exhibits to answer questions about new and existing technologies. Network with top suppliers, speakers, and participants in a relaxed atmosphere.

April 5, 2011

11:30 a.m. - 6:30 p.m.

Reception: 4:30 p.m. - 6:30 p.m.

April 6, 2011

9:00 a.m. - 2:00 p.m.

Interested in Exhibiting?

Exhibit opportunities are limited so reserve your space today! Contact Greg Williams at 313.425.3165 or email exposales@sme.org for more information.

MEDIA PARTNER

Manufacturing ENGINEERING

Look inside for information on ...

- Early confirmed exhibitors
- Three pre-conference workshops
- Conference speakers and discussions
- Special interactive tours featuring both micromanufacturing and nanomanufacturing
- FREE webinars before the event

PRE-CONFERENCE WORKSHOPS

Monday, April 4, 2011

New to the technology or just need a refresher?
Arrive a day early to attend one of these three workshops.

8:00 a.m. – 8:30 a.m. Registration/Check-in & Refreshments

8:30 a.m. – 5:00 p.m. Workshop Hours

MicroManufacturing Fundamentals

MEET YOUR WORKSHOP LEADER

J. Rhett Mayor is an assistant professor at the Georgia Institute of Technology. He holds a BScEng, MScEng, and a PhD from the University of Natal. Before joining Georgia Tech, he was President and CEO of Powerix



Technologies and an Assistant Research Scientist with the S.M. Wu Manufacturing Research Center at the University of Michigan. His primary research interests are in micromanufacturing and micro-power generation with a focus on the

development of enabling technologies through the application of integrated mechatronics design principles. His research has been sponsored by the National Science Foundation, NIST (ATP program), DARPA DSO, Department of Energy, and various industrial partners, including GM and Chrysler. Mayor has been an advisor for SME's MicroManufacturing Conference since the inaugural event in 2003 and in 2009 was awarded the SME John G. Bollinger Outstanding Young Manufacturing Engineer Award.

WORKSHOP OUTLINE

8:30 a.m. – 8:40 a.m.

Introduction to the Workshop

- Major objectives of the workshop
- Insight into why there is a need for meso-scale machine tools and micromanufacturing
- Highlights of some key issues that will be discussed

J. Rhett Mayor, Georgia Institute of Technology

8:40 a.m. – 9:25 a.m.

Introduction to Micro Machining: Mechanical Removal and Ablative Removal Processes

- Differences between micro machining, subtractive processes, and MEMS-type processing, particularly with respect to materials classes, features size, and relative precision
- Overview of existing micro machining processes considering mechanical material removal processes including micro milling, micro turning, micro- and ablative removal processes (laser, ion beam, electron beam)

J. Rhett Mayor, Georgia Institute of Technology

9:25 a.m. – 10:10 a.m.

Introduction to Micro Machining: Electric Discharge and Electrochemical Removal Processes

- Overview of existing micro EDM capabilities
- Comparison to other micro machining processes including size and material capabilities

Kamlakar Rajurkar, University of Nebraska-Lincoln

10:10 a.m. – 10:30 a.m.

Break

10:30 a.m. – 11:30 a.m.

Introduction to Micro Molding: Current Processes and Techniques

- Overview of existing micro molding technologies including injection molding, insert molding, and two shot molding
- Differences beyond size between micro molding and traditional molding

Carol Barry, University of Massachusetts – Lowell

11:30 a.m. – 12:30 p.m.

Group Lunch

12:30 p.m. – 1:30 p.m.

Introduction to Micro Forming: Current Processes and Techniques

- Overview of existing micro forming technologies
 - Size effects in micro forming, differences between micro forming and macro forming
- Gap Yong-Kim, Iowa State University*

1:30 p.m. – 2:30 p.m.

Introduction to Fixturing and Workholding

- Overview of existing technologies
 - Capabilities and limitations of existing fixturing and workholding tools
- Gloria Wiens, University of Florida*

2:30 p.m. – 2:45 p.m.

Break

2:45 p.m. – 3:45 p.m.

Micro/Meso Metrology: Characterizing Micro/Meso Products

- Review of metrology techniques suited to the needs and requirements of micro/meso scale manufacturing
 - Capabilities and limitations of micro/meso scale metrology tools, including contact and probe techniques, CMM, SEM, TEM, AFM, and various interferometric approaches including scanning white light interferometry (SWLI)
 - Application examples of SWLI metrology
- Thomas Kurfess, Clemson University*

3:45 p.m. – 4:45 p.m.

Current State of Micro/Meso-scale Machining and Machine Tool Systems Research

- Overview of ongoing research and commercially available miniaturized machine tools and micro-factory production systems
 - Initial investigations on the dynamic stability of micro-scale machining operations will be highlighted with examples of micro/meso-scale cutting operations
 - An assessment of miniaturized machine tool system technologies for the manufacture of high accuracy micro/meso-scale components and devices will be presented
- Kornel Ehmann, Northwestern University*

4:45 p.m. – 5:00 p.m.

Wrap-up

Understanding Nanotechnology: Integration and Current Applications



MEET YOUR WORKSHOP LEADER

Tihamer "Tee" Toth-Fejel has published articles and presented talks on nanotechnology since 1991. While at General Dynamics as a senior research engineer, he completed two nanotechnology research projects for the NASA Institute for Advanced Concepts. Toth-Fejel has chaired SME's Nanomanufacturing Tech Group, is a senior associate of the Foresight Nanotech Institute, on the advisory board for The Nanoethics Group, and served on the scientific advisory board of Nanorex.

WORKSHOP OUTLINE

8:30 a.m. – 11:30 a.m.

Classifications and Roadmaps

Metrology—You Can't Make it if You Can't Measure it

- Scanning electron microscopy
- Transmission electron microscopy
- Scanning tunneling microscope
- Atomic force microscopy

Applications

- Nano-enabled products
- Air and water quality
- Auto and aero
- Medicine
- Energy
- Electronics
- Space
- Food
- Consumer products
- Chemical sensors
- Electronics

11:30 a.m. – 12:30 p.m.

Group Lunch

12:30 p.m. – 5:00 p.m.

Nanostructure Techniques

- Nanoparticles
 - Properties
 - Nanoshells
 - Dendrimers
 - Carbon nanotubes
- Nanostructure manufacturing techniques
 - Layer-by-layer and Langmuir-Blodgett films
 - Self-assembly
 - Atomic layer epitaxy
 - Nanoimprint lithography
 - Dip-pen nanolithography
 - Nanoparticle synthesis techniques
 - Electron beam techniques
 - Focused ion beam (FIB)
 - Block copolymers
 - Bulk nanostructured materials, coatings, and composites

Nanodevices

- Design: NanoCAD software
- Biotemplating
- Molecular and nanoactuators

Approaches to Productive Nanosystems

- Patterned atomic layer epitaxy
- Diamondoid mechanosynthesis (DMS)
- DNA origami
- Bis-protein synthesis

Potential Problems and Opportunities

- Near term: EHS (environment, health, and safety)
- Medium term: bionanotechnology implications
- Far term: economic, military, and social issues

Metrology for MicroManufacturing and NanoManufacturing



MEET YOUR WORKSHOP LEADER

Thomas R. Kurfess is the BMW chair of manufacturing and director of Carroll A. Campbell, Jr. Graduate Engineering Center at Clemson University International Center for Automotive Research. He received his SB (Scientiæ Baccalaureus, Bachelor of Science), SM (Scientiæ Magister, Master of Arts), and PhD (Philosophiæ Doctor, Doctor of Philosophy) degrees in mechanical engineering as well as a SM in electrical engineering and computer science from MIT. Before joining Clemson University, Kurfess spent time at Carnegie Mellon University and the Georgia Institute of Technology.

Kurfess presently serves as a participating guest at the Lawrence Livermore National Laboratory in the Precision Engineering Program. He has served as a special consultant to the United Nations for the Government of Malaysia in the area of applied mechatronics and manufacturing. His research work focuses on the design and development of high-precision manufacturing and metrology systems.

WORKSHOP OUTLINE

8:30 a.m. – 8:45 a.m.

Welcome & Introduction

Thomas Kurfess, Clemson University

8:45 a.m. – 10:00 a.m.

Application and Technology in Atomic Force Microscopes (AFM)

- Nondestructive measurement from angstroms to over 100 microns
- Understanding the technology basics and impact on measurement and image capability
- Applications including dimension measurements of topography and physical properties, such as electrical properties, elasticity, modulus, and magnetic fields

Erik Novak, Bruker

10:00 a.m. – 10:20 a.m.

Break

10:20 a.m. – 11:20 a.m.

Electron Microscope: If You Can See It, You Can Measure It

- Overview of electron microscopy including operational principals and state-of-the-art technology
- Application of electron microscopy to micro and nano dimensional metrology
- Discussion of the limitations of the electron microscopes

Hideo Naito, Hitachi

11:20 a.m. – 11:30 a.m.

Morning Wrap-up

11:30 a.m. – 12:30 p.m.

Group Lunch

12:30 p.m. – 1:30 p.m.

High-precision Interferometric and Stylus Metrology for Advanced Manufacturing

- Introduction to interferometric and stylus techniques for 3D surface characterization

- Metrology requirements for modern manufacturing
- Key applications for rapid 2D and 3D surface metrology
- Advanced data processing to best quantify surfaces

Erik Novak, Bruker

1:30 p.m. – 2:30 p.m.

Confocal Laser Technology

- Describe confocal principle
- Discuss the different applications in various industries where confocal is being used
- Discuss the various types of confocal devices and their benefits

David Rideout, Olympus America

2:30 p.m. – 2:45 p.m.

Break

2:45 p.m. – 3:45 p.m.

Applications of Lasers in Multisensor Dimensional Measurement

- Application of real world metrology for micromanufacturing
- Understanding measurement capabilities of various sensors
- Understanding of tradeoffs of measurement technologies

Tom Groff, Optical Gaging Products

3:45 p.m. – 4:45 p.m.

Micro Coordinate Measurement Machine (CMM)

- Overview of micro CMM including operational principals and state-of-the-art technology
- Understanding the technology basics and impact on measurement and image capability
- Discussion of the limitations of the micro CMMs

Andre Claudet, Sandia National Laboratories

4:45 p.m. – 5:00 p.m.

Wrap-up

OVERVIEW

Whether the challenge is creating micro features on micro parts or on macro parts, participants in this event will be looking for ideas to improve their process. Exploring the many processes available, this conference brings together industry professionals to discuss the latest developments and to improve your processes today. For 2011, the event provides expanded exhibits and exhibit hours providing even more opportunity to find solutions!

Attend the MicroManufacturing Conference & Exhibits to:

- Obtain insightful information on cutting-edge technology in the industry
- Improve part quality and lower production costs
- Gain a better understanding of the proper techniques and applications that can be used in daily operations
- Learn effective solutions to real world problems
- Network with experts and peers in the micromanufacturing industry
- Have your specific questions answered and problems solved by industry experts
- Find solution vendors for nearly every micromanufacturing challenge

WHO SHOULD ATTEND

If you are interested in learning more about micromanufacturing technology, you need to attend this event.

Participants will benefit from the technology updates and networking opportunities available. This includes:

- manufacturing directors
- manufacturing managers
- new product and process development engineers
- machining specialists
- molding specialists
- quality engineers
- manufacturing engineers
- project engineers
- design engineers
- anyone working in micromanufacturing

MEET YOUR EVENT ADVISORS

Supported and guided by industry professionals, all speakers and presentations have been reviewed or recommended by a select group of industry advisors. We would like to thank the following individuals for their contribution to the development of this conference as well as their dedication to SME.

- **Carol Barry**, University of Massachusetts – Lowell
- **Donna Bibber**, Micro Engineering Solutions, LLC
- **Andre Claudet**, Sandia National Laboratory
- **Kornel F. Ehmman**, Northwestern University
- **Thomas Kurfess**, Clemson University
- **J. Rhett Mayor**, Georgia Institute of Technology
- **Shawn Moylan**, Manufacturing Metrology Division-NIST
- **Jerry Mraz**, SmalTec
- **Erik Novak**, Bruker
- **Frank Pfefferkorn**, University of Wisconsin – Madison
- **John Wallace**, Deringer-Ney

OVERVIEW

Looking to understand what nanotechnology means for you? Need to understand how and why nanotechnology can improve your products, process and may even cut costs? Interested in learning about the latest applications and trends in top-down fabrication and bottom-up assembly techniques? Then this event is for you!

This conference will highlight the current, near-term, and future applications of nanotechnology and how they are transforming the way we manufacture products. Peer networking, information sharing, and technology exchange among the world's nanomanufacturing leaders will be a key feature of the event.

Attend the NanoManufacturing Conference & Exhibits to:

- Discover the latest nanomanufacturing applications and trends in top-down fabrication and bottom-up assembly
- Investigate ways you can integrate nanomanufacturing into your products
- Understand high throughput, low cost processing
- Explore nano methods used in other applications that can be used for your application
- Network with experts and manufacturers from different industries including sensors, catalytics, medical/bio, aerospace/defense, and coatings
- Explore the closing gap between nanomanufacturing and micromanufacturing

WHO SHOULD ATTEND

If you are interested in supporting or connecting with the pace of innovation, development, and commercialization of the tools, instruments, and systems required for nano-scale manufacturing, this conference is for you. Everyone will benefit from the technology updates and networking opportunities, including:

- design and engineering
- new product and business development
- manufacturing and operations management
- material scientists
- research and development
- manufacturing and mechanical engineers
- strategic planning
- public policy makers
- technology transfer specialists
- anyone who is interested in learning more about nanotechnology

MEET YOUR EVENT ADVISORS

Supported and guided by industry professionals, all speakers and presentations have been reviewed or recommended by a select group of industry advisors. We would like to thank the following individuals for their contribution to the development of this conference as well as their dedication to SME.

- **Ahmed Busnaina**, Northeastern University
- **Dan Herr**, SRC
- **David Keenan**, Small Technology Consulting
- **Ananda V. Mysore**, Seagate Technology
- **Mike Nelson**, Nanolnk
- **Arif Sirinterlikci**, Robert Morris University
- **William Spanks**, Florida Turbine Technologies
- **Tihamer Toth-Fejel**, Novii Design, a Six3 Systems Company
- **Steven Vetter**, Molecular Manufacturing Enterprises

Day One — April 5, 2011

7:00 a.m. – 8:00 a.m.
Registration/Check-in

8:00 a.m. – 8:15 a.m.
Welcome & Introductions

8:15 a.m. – 9:00 a.m.
KEYNOTE: Interesting vs. Innovative
Jon Rambeau
Vice President for Technology Transition, Lockheed Martin

9:00 a.m. – 9:10 a.m.
Break

Micro Machining

9:10 a.m. – 9:50 a.m.
Multi-material Micro Machining by Nontraditional Processes
Several challenges associated with downscaling of nontraditional processes, namely, micro electro discharge machining, micro electrochemical machining, and micro ultrasonic machining will be discussed. A case study on the electrochemical micromachining of very high aspect ratio micro tools having diameter as small as 10 microns will be presented.
Murali Sundaram, University of Cincinnati

9:50 a.m. – 10:00 a.m.
Break

10:00 a.m. – 10:40 a.m.
Metal and Stent Cutting Using Water Jet-guided Laser Technology
A 1064 nm infrared laser was used at 2 kHz to process medical stents. Hole drilling at an 18° angle on injection nozzles for diesel and gas applications will be presented. In addition, stent machining results using Laser Microjet will be shown. The stent front side is regular and clean, with smooth and even cut walls. No contamination or heat-affected zones were observed.
Alex Schreiner, SYNOVA USA

10:40 a.m. – 10:50 a.m.
Break

10:50 a.m. – 11:30 a.m.
Improvement of Tool Life of Micro Drill Bits for PCB Manufacturing
Geometric parameters of micro drill bits for halogen-free PCB substrates and regrinding of tool tip in order to improve tool life will be presented. The helix angle and web thickness were tested with response surface methodology (RSM). Applying results to set guide line of micro manufacturing in PCB will be discussed.
Sung Hoon Ahn, Seoul National University

11:30 a.m. – 1:00 p.m.
Group Lunch & Exhibits

1:00 p.m. – 1:40 p.m.
Chip Formation in Modulation-assisted Drilling
Chip formation in drilling with controlled superimposed, low-frequency modulation — Modulation-Assisted Machining (MAM) will be presented. Controlling chip formation while simultaneously disrupting the severe chip-tool contact characteristic of continuous chip formation will be discussed. Optimal frequency and amplitude conditions will be shared and confirmed for single as well as multiple-edge drilling tools.
James Mann, M4 Sciences

1:40 p.m. – 1:50 p.m.
Break

1:50 p.m. – 2:30 p.m.
Batch Mode Micromanufacturing Based on Micro Electro Discharge Machining and Micro Ultrasonic Machining for Micro Electro Mechanical Systems (MEMS)
Batch-mode micro ultrasonic machining (μ USM) provides lithographic compatibility to the micromachining of hard ceramics, glasses and other dielectric materials that cannot be directly machined by μ EDM. This process has been applied to the batch fabrication of piezoelectric microsensors for tissue contrast detection and piezoelectric microheaters for tissue cauterization during the medical procedures of needle biopsy
Li Tao, University of Michigan

2:30 p.m. – 3:00 p.m.
Break & Exhibits

3:00 p.m. – 3:40 p.m.
MICRO EDM: Need for Speed!
There is a common viewpoint that Micro-EDM is a slow process and not suited for production. This presentation will focus on specific production applications utilizing micro EDM as the primary process. Specific examples will be provided identifying production speeds comparable to traditional methods and highlighting micro-EDM specific applications.
Jerry Mraz, SmalTec

3:40 p.m. – 3:50 p.m.
Break

3:50 p.m. – 4:30 p.m.
Ultra-high Speed and Precision Hydrostatic Spindles
Possible advantages in using ultra-high speed hydrostatic spindles for precision micromachining applications will be presented. Featuring rotational accuracy at all speed ranges within 0.1 micrometer in both axial and radial directions, hydrostatic spindle are able to provide unprecedented surface finish. High damping ratio of the spindle bearings makes tool rotation virtually free of internally generated vibrations that can be caused by imbalance forces.
Leonid Kashchenevsky, ELKA Precision

4:30 p.m. – 6:30 p.m.
Exhibits Reception

Micro Molding

9:10 a.m. – 9:50 a.m.

Evaluations and Troubleshooting of Challenging Micro Molding Applications

Challenges of advanced micro molding processes include small metering volume, residence time of advanced polymers, super quick fill time, and controlling warpage and distortion of thin-wall sections. Case studies include: short shot study, process window development, micro molding special machine settings, common filling issues and troubleshooting methods, and unique injection setting to overcome flash and short problems.

Kohei Shinohara, Sodick Plustech

9:50 a.m. – 10:00 a.m.

Break

10:00 a.m. – 10:40 a.m.

Where's the Heat?

Good design practices for thermal considerations will be presented. This will include the transfer of heat through a sample mold design, methods used to obtain accurate and near instantaneous temperature readings of micro mold surfaces to verify effective heat transfer. Techniques to improve heat transfer when it is less than desired will be discussed.

Mark Kinder, Plastic Design Corporation

10:40 a.m. – 10:50 a.m.

Break

10:50 a.m. – 11:30 a.m.

Maximizing the Benefits of Converting from Micromachining to Micromolding for Your Next MIS Device

There are a number of factors to consider regarding micromachining versus micromolding prior to submitting a medical device for FDA approval. Discussion will include why it is important to obtain FDA approval for a device using micromolded components, part geometry changes to consider for micromachining to micromolding conversion, and testing changes to consider for micromachining to micromolding conversion

John Whyntott, Mikrotech

11:30 a.m. – 1:00 p.m.

Group Lunch & Exhibits

1:00 p.m. – 1:40 p.m.

Transforming Surfaces with Micromolding

Low-cost metal tools for micromolding made of steel of any size and shape and have lithographically defined microstructures on their surface will be presented. These microstructures can dramatically affect the surface appearance, hydrophobicity, friction coefficient, ice formation, and boiling nucleation. Several applications from customers in the automotive, energy, and aerospace industries will be discussed.

William King, University of Illinois-Urbana-Champaign

1:40 p.m. – 1:50 p.m.

Break

1:50 p.m. – 2:30 p.m.

Micro Molding for Medical Applications — Top 10 Tips for Successful Programs

How to select the right material for the best results in micro molding, taking into consideration the use of the micro part in the final device, will be presented. Importance of quality and challenges in validating a micro molding component will be explored. How the micro part fits into the finished device will be discussed.

Patrick Kavanaugh, SMC

2:30 p.m. – 3:00 p.m.

Break & Exhibits

3:00 p.m. – 3:40 p.m.

Design, Molding, and Inspection of Precision Micro Gears

Development of a geared system including prototyping single cavity gears in traditional molding machines and a multi-cavity production tooling on a dedicated micro molding machine will be presented. Differences between the two processes will be discussed along with an approach to the challenges of precision inspection of micro parts.

Roderick Kleiss, Kleiss Gears

3:40 p.m. – 3:50 p.m.

Break

3:50 p.m. – 4:30 p.m.

PANEL DISCUSSION:

Ask the Micro Molding Experts

Experts representing various molding methods will answer questions on how best to address your micro molding challenges. They will provide practical ideas you can use immediately. Attendees are encouraged to bring questions, drawings, and parts to the conference.

4:30 p.m. – 6:30 p.m.

Exhibitor Reception

Emerging MicroManufacturing Technologies & Applications

9:10 a.m. – 9:50 a.m.

Laser Deburring: An Overview for Precision Edge Needs

All aspects of the edge quality produced by a variety of laser types in a variety of materials will be presented. Key characteristics of the lasers used today that influence edge quality will be discussed, providing an overview of how each affects different materials and insight into the best choices for precision deburring.

LaRoux Gillespie, Consultant

9:50 a.m. – 10:00 a.m.

Break

10:00 a.m. – 10:40 a.m.

Pulsed Laser Micro Polishing of Metals

Results of polishing various metal alloys that were micro end milled achieving surface roughness reductions of 30% and 50% will be presented. Predicting the final surface roughness produced by a particular laser pulse on a surface of known initial surface roughness will be shared. A case study for improving mold roughness to create polymer parts that have stronger adhesion during assembly will be briefly presented.

Frank Pfefferkorn, University of Wisconsin-Madison

10:40 a.m. – 10:50 a.m.

Break

10:50 a.m. – 11:30 a.m.

New 3 – 5 Axis Laser Ablation Technology for Surface Structures

How new laser ablation technology produces texturizing, engraving, micro-structuring, marking and labeling of 2D geometries right through to complex 3D geometries will be presented. Laser ablation will be compared to conventional surface treatment using manual etching processes, describing economic, ecological and design advantages.

Gisbert Ledvon, AgieCharmilles LLC

11:30 a.m. – 1:00 p.m.

Group Lunch & Exhibits

1:00 p.m. – 1:40 p.m.

Drug Delivery Micro Devices — From R&D to Factory

Many therapeutic devices are now including pharmaceutical compounds and materials to provide patients with pain management and create minimally invasive strategic value. Traditional processing techniques, even “traditional” micro manufacturing practices are challenged with proper design, manufacturability, handling, storage, and validation using these types of materials in medical and drug delivery devices. The basic techniques of prototype to production scalability of drug delivery devices and how to manage a highly iterative but robust process throughout each phase of their development without losing control and potency of the materials will be presented.

Donna Bibber, MicroEngineering Solutions

1:40 p.m. – 1:50 p.m.

Break

1:50 p.m. – 2:30 p.m.

A Method for Creating Forming Limit Diagrams of Microformed Thin Sheets

Determining forming limits of microformed thin sheets by characterizing material behavior and addressing the effect of miniaturization and size effect on the forming processes will be presented. A formability map that provides stretchability limits provides for better understanding of failure modes. A comparison of the microstructure-driven material behavior versus conventional macro-scale forming of the same alloy will be discussed.

Nasr Shuaib, Pratt & Whitney

2:30 p.m. – 3:00 p.m.

Break & Exhibits

3:00 p.m. – 3:40 p.m.

Laser-induced Plasma Micro-machining (LIP-MM)

The Laser-induced Plasma Micro-machining (LIP-MM) process is a novel micro-machining process that utilizes plasma, generated inside a dielectric by tightly focusing an ultra-short laser beam to perform micro-machining in a wide range of materials. Since no tool is required the limitations encountered in processes such as micro-EDM are circumvented. It has been used for complex 3D features in many difficult to machine materials.

Kumar Pallav, Northwestern University

3:40 p.m. – 3:50 p.m.

Break

3:50 p.m. – 4:30 p.m.

Interested in speaking?

As of December 15, 2010, this spot is still open for an emerging micromanufacturing technology or application presentation. Contact Lauralyn McDaniel at 313-425-3108 if interested.

4:30 p.m. – 6:30 p.m.

Exhibits Reception

NanoManufacturing

9:10 a.m. – 9:50 a.m.

Nanomanufacturing with Polymers: Converting Research to Reality

Templates and assembly processes for directing the assembly of a variety of nanoelements, including nanoparticles, nanotubes, and polymers will be presented. The process takes less than five minutes and can be utilized for real time processing. High volume mixing of nanoelements into polymers, extruded multilayer films, and electrospinning of nanofibers and applications to EMI shielding, flexible electronics, structural materials, and novel sensors will be discussed.

Joey Mead, University of Massachusetts – Lowell

9:50 a.m. – 10:00 a.m.

Break

10:00 a.m. – 10:40 a.m.

Programmable Soft Lithography: Solvent-assisted Nanoscale Embossing

Solvent-assisted nanoscale embossing (SANE), a nanofabrication platform that can generate “from a single master” large-area nanoscale patterns with programmable densities, fill factors, and lattice symmetries will be presented. The process can increase the spacing of patterns up to 100% and decrease them down to 50% in a single step by stretching or heating a polymer substrate.

Teri Odom, Northwestern University

10:40 a.m. – 10:50 a.m.

Break

10:50 a.m. – 11:30 a.m.

Applications of Carbon Nanotubes to Achieve Enhanced Performance and Cost Reduction

An overview of carbon nanotube-based composites, the integrity and robustness of these materials, the unique properties enabled, cost reductions that can be achieved, applications for which they are being applied, and their impact on manufacturing will be presented.

Margaret Johns, Bluewater Consulting

11:30 a.m. – 1:00 p.m.

Group Lunch & Exhibits

NanoManufacturing *(continued)*

1:00 p.m. – 1:40 p.m.

Review of Nanopositioning for Nanomanufacturing and Metrology Applications

A detailed methodology for innovating flexure-based mechanism topologies, precision actuator and sensor selection and placement, and subsequent optimization and real-time control will be shared. Case studies will include a large-load capacity positioner applicable for micro hot-embossing and a high-bandwidth flexure-based scanner for positioning a probe or a sample in scanning probe microscopy.
Vijay Shilpiekandula, Mitsubishi

1:40 p.m. – 1:50 p.m.

Break

1:50 p.m. – 2:30 p.m.

Improving the Performance of Micro End Mills Using Nanocrystalline Diamond Coatings

Demonstration of performance enhancement of micrometer scale tooling using thin diamond coatings will be presented. Results show lower tool wear and breakage, lower adhesion of aluminum to the tool, and

significantly lower cutting forces allowing the increase in material removal rates. Coating allows machining without lubricants and essentially eliminates metal burrs, thereby reducing the environmental impact and improving performance for micro and meso-scale applications.

Patrick Heaney, NCD Technologies

2:30 p.m. – 3:00 p.m.

Break & Exhibits

3:00 p.m. – 3:40 p.m.

Self-assembled Nanostructures

Work to understand and explore various self-assembly mechanisms to pattern nanoscale structures will be presented. The modeling and simulation of the self-assembly process and guided self-assembly suggest that these mechanisms may be broadly applied to diverse systems and thus enable a broad range of applications and potential products. How these structures may motivate novel applications in solar cells, drug testing, sensors and biomimetic structures will be discussed.

Wei Lu, University of Michigan

3:40 p.m. – 3:50 p.m.

Break

3:50 p.m. – 4:30 p.m.

Applications of Tip Based Lithography in NanoMedicine

In diagnostics, miniaturization has the potential for higher detection sensitivity, reduced assay time, and better compatibility with lab-on-a-chip technologies. Miniaturization technologies also enable the interrogation of cellular processes at single cell levels which could prove to be invaluable to tissue engineering. A tip based lithography platform and related applications for MEMS biosensor functionalization and single cell assays has been developed. This platform has the potential to play a fundamental role in developing novel manufacturing methods for Nanobiomedical sciences.

Saju Nettikadan, NanoInk

4:30 p.m. – 6:30 p.m.

Exhibits Reception

Exhibits & Networking Reception

April 5, 2011

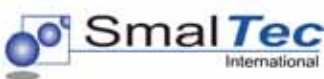
11:30 a.m. – 4:30 p.m.

Reception: 4:30 p.m. – 6:30 p.m.

April 6, 2011

9:00 a.m. – 2:00 p.m.

FEATURED EXHIBITORS



EARLY CONFIRMED EXHIBITORS *(as of 12/15/2010)*

Visit either event Website for the most current list of exhibitors.
www.sme.org/micro | www.sme.org/nanomanufacturing

- | | |
|---------------------------------|-------------------------|
| Accumold | Makino |
| Aerotech | Makuta Technics |
| AgieCharmilles | Microlution |
| Alabama Laser | MICROmanufacturing |
| ALIO Industries | NSK America Corp. |
| Atometric | NanoInk |
| BIG Kaiser Precision Tooling | Olympus America |
| Blum Laser Measuring Technology | Phillips Plastics |
| Carl Zeiss IMT | Plastic Design Corp. |
| Carl Zeiss Industrial Metrology | Sarix SA |
| CGI Inspection | Scientific Molding |
| Deringer-Ney | SmalTec International |
| FineLine Prototyping | Sodick Plustech |
| Gateway Laser Service | Teamvantage |
| Jesse Garant & Associates | Top Tool Company |
| KERN Precision | Vision Research |
| Kyocera Micro Tools | Yasda Precision America |
| Lion Precision | |

Interested in Exhibiting? Exhibit opportunities are limited so reserve your space today!
Contact Greg Williams at 313.425.3165 or email exposales@sme.org for more information.

Day Two — April 6, 2011

7:30 a.m. – 8:00 a.m.
Morning Refreshments

Micro Metrology

8:00 a.m. – 8:40 a.m.
Industrial Computed Tomography (CT) Scanning – How to Improve Your Quality and Increase your Competitive Edge
A brief outline of various industrial CT scanning systems with the analysis that can be completed will be presented using case examples. Application areas include full metrology and various inspection/analysis techniques such as void analysis, assembly analysis, part to CAD or part to part comparison and full GD&T analysis.
Stephanie Masse, Jesse Garant & Associates

8:40 a.m. – 8:50 a.m.
Break

8:50 a.m. – 9:30 a.m.
3D Scanning and Inspection of Micro-molded Parts
3D scanning small molded parts by reverse rapid prototyping makes digital pictures of ultra-thin layers of the physical part and translates these cross-sectional pictures into a 3D computer representation of the physical part. The point cloud can be used for inspection or reverse engineering of a physical part. Some practical application examples of this 3D scanning technology will be presented.
Gary Johansson, Matrix Tooling and Craig Crump, CGI

9:30 a.m. – 9:40 a.m.
Break

9:40 a.m. – 10:20 a.m.
Microprobes Metrology
A study is being carried out integrating newly developed probes into an ultra-precision, eight motion control stage. Measured contact point deviations are used in one direction as a measure of repeatability. A gage block artifact has been produced and multiple measurements of surface separation are used to determine deviations of dimensional measurement for the simplest

possible case. An overview of existing and newly developed microprobes will also be presented.
Borja de la Maza, Innovaia Association

10:20 a.m. – 10:30 a.m.
Break

10:30 a.m. – 11:10 a.m.
Interested in speaking?
As of December 15, 2010, this spot is still open for an emerging micromanufacturing technology or application presentation. Contact Lauralyn McDaniel at 313-425-3108 if interested.

11:10 a.m. – 11:30 a.m.
General Questions/Wrap-up

11:30 a.m. – 12:15 a.m.
Group Lunch

NanoManufacturing

8:00 a.m. – 9:30 a.m.
PANEL: Recent Advances and Challenges in Nanomanufacturing
Current nanotechnology research focuses on surface modification, matching molecules, and “sockets” at the level of manipulating several to several hundred particles or molecules to be assembled into desirable configurations. Commercial scale-up and the promised economic windfall, however, will not be realized unless one can perform high-rate/high-volume assembly of nanoelements economically using environmentally benign processes. This includes understanding what is essential for a rapid multi-step or reel-to-reel process, as well as for accelerated-life testing of nanoelements and defect-tolerance.

The panel will address moving from the R&D phase and prototyping to the commercialization phase, and preferably onto volume production. Current developments and successes in transitioning research into commercial products will also be discussed. Each panelist will make a short presentation, which will be followed by questions from conference participants. Don't miss this chance to pose your question to a group of nanotechnology leaders.

9:30 a.m. – 9:40 a.m.
Break

9:40 a.m. – 10:20 a.m.
Breakthrough Nanotechnology Companies
This presentation will review the progress of established companies and the bright spots appearing in new companies as they attempt to define a breakthrough position in the developing nanotechnology industry.
David Keenan, Small Technology Consulting

10:20 a.m. – 10:30 a.m.
Break

10:30 a.m. – 11:30 a.m.
Technology Roadmap for Productive Nanosystems
The first edition of the Technology Roadmap for Productive Nanosystems was completed in the fall of 2007. Long anticipated by those interested in atomically precise manufacturing (APM), the document:

- articulates compelling reasons to develop and scale up APM;
- surveys current capabilities in nanosystem design, modeling, fabrication, and testing;
- provides examples of intermediate applications that could drive development;
- identifies a range of technical approaches;
- outlines strategies for developing more advanced systems; and
- recommends ways for existing institutions

to focus their efforts toward APM.

The Technology Roadmap for Productive Nanosystems identified the gaps between manufacturing technologies for today's basic nanostructured materials, and a manufacturing system based on productive nanosystems to make large atomically precise structures. The progress made to narrow this gap will be the topic of this presentation.
David Forrest, Naval Surface Warfare Center

11:30 a.m. – 12:15 p.m.
Group Lunch

Conference Tours

April 6, 2011 • 12:30 p.m. – 4:00 p.m.

Conclude your experience at the MicroManufacturing and NanoManufacturing Conferences & Exhibits by attending one of the tours.

Argonne National Laboratory

Argonne National Laboratory, chartered in 1946, is the nation's first national laboratory and one of the U.S. Department of Energy's largest research centers. A direct descendant of the University of Chicago's Metallurgical Lab, where the first controlled nuclear chain reaction was created, Argonne's first mission was to develop nuclear reactors for peacetime purposes. Over the years, Argonne's research has expanded to include many other areas of science and engineering from studies of the atomic nucleus, to global climate changes. Participants will see and learn about several areas including the Center for Nanoscale Materials and the Advanced Photon Source.

NOTE: Due to the nature of the facility, any non-U.S. citizens **must be pre-registered by March 22, 2011** and will be required to complete an access form for clearance to enter the facility.

Northwestern University Micromanufacturing-Related Laboratories

The laboratory tour will highlight some of the activities and capabilities related to miniaturization technologies covering the nano-to meso-scale manufacturing domains. During the tour a number of live demonstrations of active projects will be given. Participants on this tour will visit several labs including:

- Micromanufacturing (micro-forming, micro-cutting, micro-laser processing, micro-metrology)
- Nano/Micro-fabrication and characterization (nano-imprinting, projection microstereolithography)
- Nano/Micro tribology
- Surface science facility

NOTE: All tour participants are subject to final approval by the host facilities, which reserve the right to **PRESCREEN** and **DECLINE** attendance for the tour. Cameras are not allowed on either tour.

Visit either event Website for extended presentation descriptions, speaker biographies and the latest information on these conferences.

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**NANO
MANUFACTURING**
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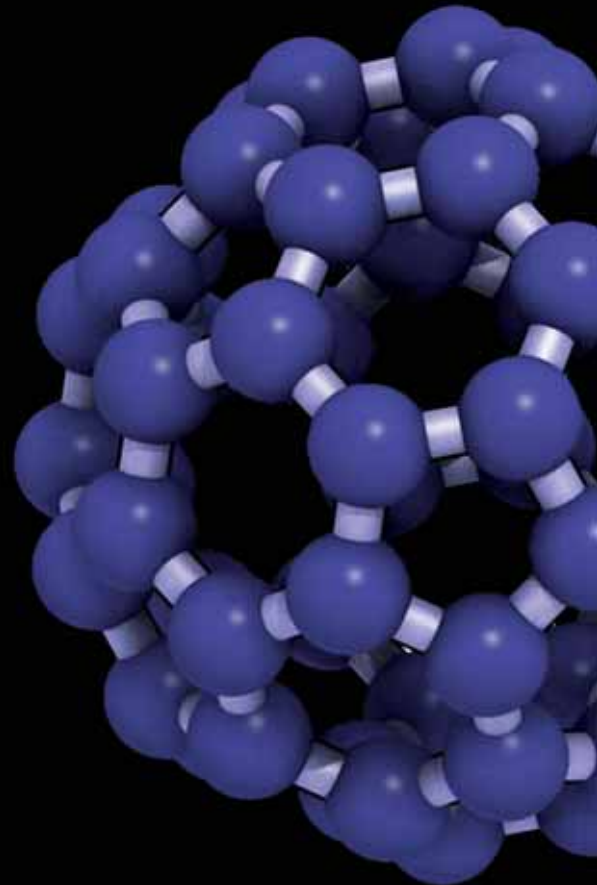
FREE Webinars Before the Event

Catch any of these on demand webinars **FREE** by visiting either event Website and clicking **FREE Webinars** before the Conference link.

- Atomic Force Microscopy: Enabling Characterization of Biological Structures and Forces at the Nano-scale
- Breakthrough Nanotechnology Companies (2010) — *You must be an SME member to view this webinar*
- Micro Molding with Resorbable Materials
- Micro Molding: Differences Beyond Size to Traditional Molding
- MicroManufacturing: Getting Even Smaller
- Overview of Nanotechnology Developments in the UK & China — *You must be an SME member to view this webinar*
- Understanding NanoManufacturing: An Introduction to a New World

www.sme.org/micro

www.sme.org/nanomanufacturing



LOCATION

Drury Lane Conference Center
100 Drury Lane
Oakbrook Terrace, IL 60181
P: 630.530.8300

LODGING

Hilton Suites Chicago/Oak Brook
10 Drury Lane
Oakbrook Terrace, IL 60181
P: 630.941.0100
F: 312.332.9025

Visit either event Website for online reservations or call 630.941.0100 and press "1" for reservations. Mention the Society of Manufacturing Engineers or group code SME for the group rate.

A block of rooms at reduced rate of \$120/per night (single/double), which includes Internet, is being held at the Hilton Suites Chicago/Oak Brook for attendees of these events. **Rooms in the block not reserved by March 20, 2011 will be released.** After this date, reservations will be accepted but cannot be guaranteed at SME's group rate.

Transportation & Parking

The Hilton Suites offers a direct airport shuttle to/from O'Hare and Midway airports for \$25/per person, one way with Windy City Limousines. Visit either event Website to make your shuttle reservation in conjunction with your stay at the Hilton. Self-parking is complimentary on the premises.

PRICING & REGISTRATION

Save on your registration by becoming an SME member and enjoying all the benefits an SME membership has to offer!

For membership details visit www.sme.org/join.

REGISTRATION OPTIONS

- Call SME Customer Care at **800.733.4763** or **313.425.3000** ext. **4500**, Monday – Friday, 8:00 a.m. – 5:00 p.m. ET
- Register online at www.sme.org/micro or www.sme.org/nanomanufacturing
- Download a PDF from either event Website to fax or mail your registration

Students and educators, visit either event Website for special rates and registration forms.

Conference registration includes lunches, exhibits, reception, keynote presentation, poster session, and a special interactive tour.

FULL CONFERENCE <i>April 5 – 6, 2011</i>	SME MEMBERS	NONMEMBERS
MicroManufacturing Conference & Exhibits Early bird registration through March 20, 2011 Standard registration beginning March 21, 2011	\$795 \$845	\$895 \$945
NanoManufacturing Conference & Exhibits Early bird registration through March 20, 2011 Standard registration beginning March 21, 2011	\$795 \$845	\$895 \$945
PRE-CONFERENCE WORKSHOPS <i>April 4, 2011</i> Early bird registration through March 20, 2011 Standard registration beginning March 21, 2011	\$445 \$495	\$545 \$595
EXHIBITS ONLY <i>April 5, 2011, 11:30 a.m. – 6:30 p.m. and April 6, 2011, 9:00 a.m. – 2:00 p.m.</i>	\$25	\$45

Attendance is limited and only preregistered, prepaid registrants will be guaranteed access to the program. Registrations made less than two weeks prior to the program should be made by calling 800.733.4763. Upon receipt of your paid registration, you will be sent a registration confirmation.

ON-SITE REGISTRANTS: On-site registration is on a space-available basis. Payment is due on-site.

CANCELLATIONS: Cancellations will receive a full refund if made on or before March 20, 2011. Beginning March 21, 2011, cancellations will only receive a 50% refund. You must obtain a cancellation number from our registrar to verify your cancellation. Confirmed registrants who fail to notify SME of his/her cancellation are not eligible for a refund.

PROGRAM CHANGES: SME has the right to amend this program as necessary. In the event of a cancellation, SME is not responsible for incidental costs incurred by registrants. We recommend purchasing refundable airline tickets.



Please call
800.733.4763 should
you require assistance.

Complete registration policy is available on both event Websites at
www.sme.org/micro or www.sme.org/nanomanufacturing.



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