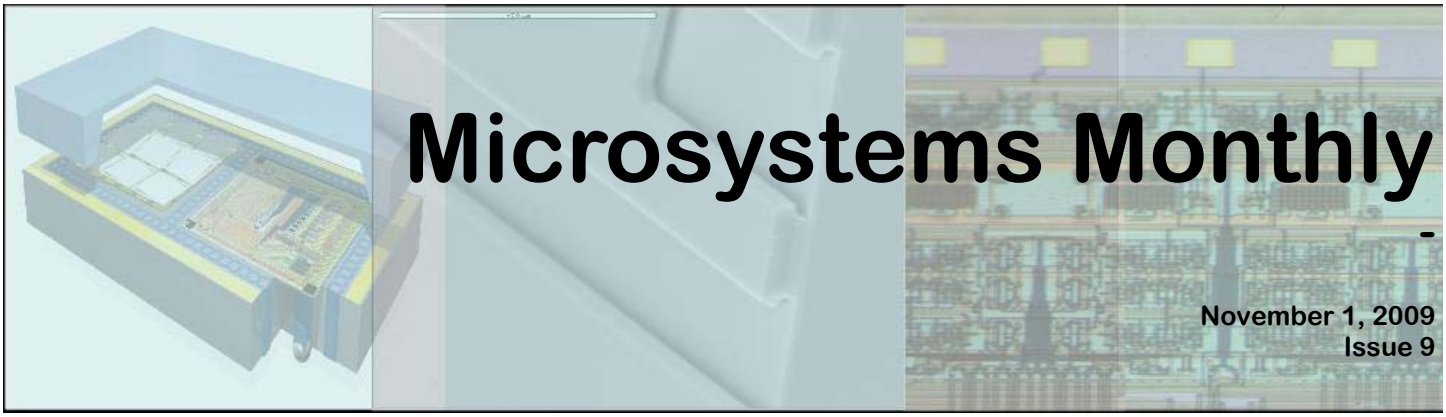


Microsystems Monthly

November 1, 2009
Issue 9

Mid-Atlantic MEMS Alliance Mission Statement:

To network expertise, capabilities, and research to facilitate the development of new applications and commercialization of miniaturization technologies.

Highlights:

Multi University Research Initiative (see page 3)

8:00 a.m. - 4:00 p.m. Georgetown University
3700 O St NW
Washington, DC 20057-0002 Agenda Finalized

www.mems-alliance.com

WISE OPPORTUNITY

Each year, outstanding engineering students are selected to spend nine weeks in a special summer prograr Washington, D.C. to learn how government officials make decisions on complex technological issues and ho engineers can contribute to legislative and regulatory public policy decisions. The WISE Program is ranked one of the best Internship opportunities in the U.S. by the Princeton Review.

New!

WISE Seeks Faculty-Member-In-Residence For Summer 2010 Program

If you are an outstanding faculty member or policy professional, WISE needs you to mentor and teach engineering students about the interaction between S&T and policymaking during the 2010 WISE Program Washington, DC. **The deadline for applications is 31 January 2010.**

Chairperson's Notes——-

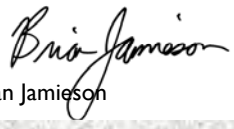
Networking and the MEMS Alliance

Since its inception over ten years ago, one of the explicit goals of the MEMS Alliance has been to increase networking among the practitioners of MEMS in the mid-Atlantic area. Originally, the idea of banding together to share facilities and to increase the visibility of the still-emerging discipline of MEMS was paramount. Many researchers at that time were either operating in an existing circuits or detector fab, or else cobbling together fabrication equipment on a lab-by-lab basis. Things have come a long way since then, with state-of-the-art facilities dedicated all or in part to MEMS springing up throughout the region, including (among many others) the NanoCenter at the University of Maryland and the NIST NanoFab. Yet, while the importance of equipment and process sharing may have diminished, networking remains one of the primary aims of the MEMS Alliance.

To begin with, the Symposia and workshops sponsored by the MEMS Alliance are an important opportunity to keep up your "technical chops", and learn what's going on in MEMS both inside the Mid-Atlantic area and throughout the nation and world. The MEMS Alliance has always been successful in attracting national-caliber speakers to what is essentially a regional conference, and this year is no exception. But, just as important as the headliners is the chance to catch up with our "ordinary" colleagues who often seem to have a suggestion for how to do things better- whether it's a new vendor, a new tool, or a new technique. I've found that some of the best learning at past symposia has gone on during lunch and happy hour. Understanding government funding trends and hearing from representatives of government agencies is of course another way in which we try to promote networking. As listed in our monthly newsletters, recent months have shown a marked increase in RFP's in the areas of MEMS and nanotechnology for energy and environmental sensing by DOE, the EPA and other government funding sources. We are looking forward to better understanding emerging needs in those areas.

Lately we've been wondering whether it might be time to think about new ways of networking. A quick scan of Linked-In shows a fairly healthy MEMS user group with some lively discussions, while Facebook hosts a fledgling MEMS group in Texas. The MEMS Industry Group is active and seems to generate some useful discussion in both domains. Twitter does not seem, as yet, to be tweeting with late-breaking MEMS news, and it's a little hard to imagine that MEMS will generate the same spur-of-the-moment excitement of a Brad Pitt sighting. Still, we wonder whether some social networking among our group could liven things up a little. So, in the spirit of adventure we've launched a Facebook Group called "Mid-Atlantic MEMS Alliance." To begin with, we're soliciting input on interesting questions to ask our panelists in the area of "technology pull" for environmental sensing and energy applications, and have started discussion threads accordingly. Please check out this new group, join, and weigh in with any suggestions you have.

Best regards,



Brian Jamieson

2009 MD SBIR—Conference

U.S. Small Business Administration Executive and Pioneering CEO of Vecna Technologies, Inc. to Provide Keynote Addresses at 2009 MD SBIR Conference

Innovation and Investment: 2009 MD SBIR Conference, hosted by TEDCO and its partners, Prince George's County Economic Development Corporation (PGCEDC) and Maryland Small Business Development Center (SBDC), on Tuesday, November 17, 2009 will feature two top-notch keynote addresses.

The morning keynote address will be provided by **Sean Greene, Associate Administrator for Investment Innovation, U.S. Small Business Administration (SBA),** followed by an afternoon keynote address by **Deborah Theobald, Chief Executive Officer, Vecna Technologies, Inc.**

The ***Innovation and Investment*** SBIR Conference agenda also includes a wealth of panelists from public, private, and Federal agency entities, including: DawnBreaker, 20/20 GeneSystems, Inc., National Science Foundation, Rensynsys LLC, and more.

A key component of the program is the closing session where attendees are able to meet *"One on One"* with SBIR managers and experts from Federal Agencies! See the Detailed Agenda with panel descriptions and other helpful information.

Registration closes soon. Register in advance for $99. Limited onsite registration is available for $125.

Click here for more.

Synopsis BAA 10-002 **Response Date** White Papers: Friday 11 December 2009

Full Proposals: Tuesday 02 March 2010 http://www.onr.navy.mil/02/BAA/

The MURI program supports basic science and/or engineering research at U.S. institutions of higher education (hereafter referred to as "universities") that is of potential interest to DoD. The program is focused on multidisciplinary research efforts that intersect more than one traditional science and engineering discipline to address issues of critical concern to the DoD.

White papers and full proposals addressing the following topics (1) through (10) should be submitted to The Office of Naval Research:
(1) Optical Metamaterials
(2) Adaptive Cognitive Maps for Autonomous Systems
(3) Non-linear Mediums Converting Frequencies of Propagating E/M and Pressure Waves
(4) Biofuels: Microbial Communities, Biogeochemistry and Surface Interactions
(5) Design, Synthesis, and Characterization of Electro-Active Polymers for Dielectric Energy Storage
(6) Reasoning for Image Understanding in Uncertain Environments
(7) Fundamental Study of High- and Low-K Dielectrics for III-V Electronic Devices
(8) Provably-Safe Perception-Based Control for Autonomous UAS Operations around Complex, Unstructured Terrain
(9) Dynamical Systems Theory in 4D Geophysical Fluid Dynamics
(10) Hyperspectral, Radar and EO/IR Signatures in the Littorals
White papers and Full proposals addressing the following topics (11) through (20) should be submitted to the Air Force Office of Scientific Research (AFOSR):
(11) Novel Catalytic Mechanisms for the Chemical Reduction of Carbon Dioxide to Energy-Dense Liquids
(12) Third Order Nonlinear Optical Organics
(13) Fundamental Processes in High-Temperature Gas-Surface Interactions
(14) Propagation of Ultrashort Laser Pulses through Transparent Media
(15) Superconducting Semiconductors
(16) Human-Machine Adversarial Networks
(17) Biologically-Engineering of Adherent / Spectroscopically Interrogated Microstructures
(18) Control of Information Collection and Fusion
(19) Stable Metrics for Global Inference in Social Networks to Predict Collective Behavior
(20) Solid State Cooling
White papers and full proposals addressing the following topics (21) through (30) should be submitted to the Army Research Office (ARO):
(21) Neuronal Behavior in Primary Blast
(22) Identifying and Extracting the Mathematical Signatures of Prokaryotic Activity in DNA; Developing a Theoretical Foundation for Predicting DNA Stability
(23) Tomography of Social Networks of Asymmetric Adversaries
(24) Adaptive Perception and Agile Autonomy in Severe Environments
(25) Structured Modeling for Low-Density Languages
(26) Directed Self-Assembly of Reconfigurable Materials
(27) "Atomtronics": A generalized electronics
(28) Bio-Electronic Templates for Interfacing to the Nanoscale
(29) Ion Transport In Complex Heterogeneous

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Electronic Infrastructure and Packaging for Mesoscale Systems

C. Paul Christensen and Lori Beer Potomac Photonics, Inc.
Lanham, MD.

Mesoscale systems are built by connecting a group of miniature devices – for example, MEMS sensors, electronic or optoelectronic chips, miniature power sources – and enclosing them in a suitable package. To accomplish its function, a mesoscale sensing system must have 5 essential features: (1) a source of power, (2) a means of communication with the outside world, (3) a means of processing signals, (4) a sensing or actuating element, and (5) a package to protect it in its intended environment. Often, the sensing or actuating device is a MEMS component. In this case, the other essential elements, items (1) – (3) and (5), together can be thought of as infrastructure that supports operation of the MEMS component and interfaces it with the outside world. In the macro world we recognize that office buildings provide similar infrastructure – power (electricity), communications (internet/phone), data processing (computers) and protection from the environment (walls and roof) – to support the working elements (people) inside. In this larger world, standard, but adaptable, construction technology has evolved to provide this infrastructure. However, "mesoscale" infrastructure concepts are at an early phase of their evolution, and much work remains to be done.

A new group at Potomac Photonics, Inc. under the leadership of Dr. Paul Christensen, its Founder, is developing next generation techniques for fabrication of mesoscale system infrastructure – power, signal processing/communication, and packaging. Just as a macro-scale building can be constructed in different shapes and sizes with different materials and internal structure, there is a need for infrastructure platforms to be adaptable to the many constraints presented by the wide range of mesoscale system applications. Building upon work conducted from 1998 to 2002 under the DARPA Mesoscale Conformal Electronics (MICE) program, the company will combine precision laser fabrication techniques, nanomaterials, and advanced battery and energy scavenging technology to produce an integrated approach to mesoscale system infrastructure. The result of these innovations will substantially simplify implementation of new system concepts and have the potential to reduce size, cost and maintenance requirements of many mesosystems currently on the market.

It's a grand vision and a big job, but Potomac has released some of the examples shown here as a study of this work-in-progress. Initial work used alumina substrates on which miniature interconnect circuits were fabricated by silver paste filling of laser-milled channels and pads. Attaching miniature IC's and 0201 and 0402 passives resulted in a working circuit, shown in Fig. 1, with overall dimensions of only a few millimeters. This fabrication technique allows use of very narrow conductors that are embedded below the substrate surface, and allows routing of traces between pads to minimize the need for multilayer circuitry. For example, with more conventional interconnect technology the single-layer circuit shown in Fig. 1 would require two conductor layers for realization.

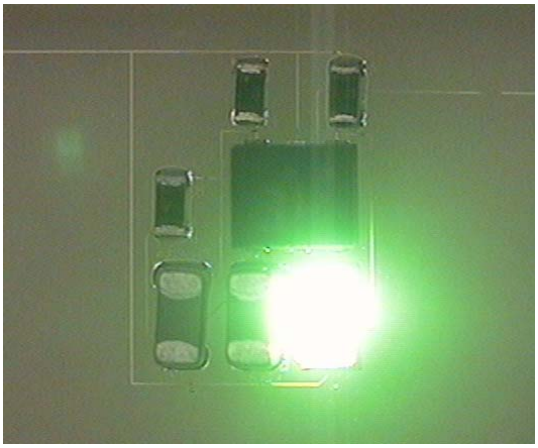

Fig. 1. Potomac LED control circuit using embedded conductors on a polished alumina substrate. Width of the circuit is 3 mm. The LED is show in its "on" state.

UPCOMING EVENTS

http://www.powermems.org/ The 9th International Workshop on Micro and Nanotechnology for Power Generation and Energy Conversion Applications

PowerMEMS 2009

December 1-4, 2009 Washington DC, USA **Organizing Committee Chair:** Professor Reza Ghodssi, University of Maryland, USA **Technical Program Co-Chairs:** Professor Carol Livermore, Massachusetts Institute of Technology, USA Professor David Arnold, University of Florida, USA

Technical Topics of Interest Include : Energy scavenging for remote sensors and microsystems, Thermoelectric and photovoltaic materials and systems, Piezoelectric, electrostatic and electromagnetic conversion, Energy management and microsystem integration, Nanostructured materials for energy and thermal management, Micro fuel cells and micro reactors for fuel processing, Micro/nano catalysis, combustion, heat and mass transfer , Micro thrusters and miniature propulsion microsystems, Biologically-inspired energy conversion and cooling, Micro heat engines for power generation and propulsion Micro and nanofabrication for energy applications, Micro coolers and other thermal management technologies

POSITION OPENINGS IN THE AREA

Date Posted: Oct. 5, 2009
Job Title: Postdoctoral Researcher -- MEMS and Microfabrication

Department: Mechanical Engineering Department

Institution: University of Maryland
College Park, MD
Application Deadline: Dec. 1, 2009

Position Start Date: Available Immediately
Job Categories: Graduate Student
Post-Doc
Academic Field(s): Mechanical Engineering Engineering Mechanics Engineering - General
Job Website: http://mems.umd.edu

Job Description:
A Postdoctoral Research Position is available immediately for a skilled MEMS and Microfabrication Researcher, focused on the development of ultrasonic silicon micromotors.
The position requires a strong background in Silicon Microfabrication Process Development.
Experience with multi-wafer bonding and integration, piezoelectric MEMS fabrication and characterization, dynamic system and interfacial contact modeling, device testing and/or related skill sets is highly desirable, but not required.
Research will be performed collaboratively in the Maryland MEMS and Microfluidics Laboratory (http://mems.umd.edu), the Maryland Nanocenter (http://www.nanocenter.umd.edu/labs/FabLab/) and the nearby Army Research Laboratory, in Adelphi, MD. Salary is commensurate with experience. The position is for a 1 year appointment, renewable for 3 additional years, based on performance and availability of funds.

Continued from page 4 **Electronic Infrastructure and Packaging for Mesoscale Systems**

d from page 4 Laser milling followed by paste filling minimizes the need for photolithographic masks, plating tanks, photoresist and the entire associated chemical effluent stream. As a consequence, the fabrication processes are relatively environmentally friendly as well as being well suited to the short design cycles and moderate batch sizes that are often associated with new mesoscale systems. Although ceramic substrates are useful in some specialized applications, a larger market need exists for infrastructure based on organic materials. Through use of new electronic nanomaterials that allow high quality conductors to be deposited from paste and sintered at temperatures compatible with organic substrates, the embedded conductor approach can be extended to packaging based on polyimide, liquid crystal polymer, ABF (Ajinomoto Buildup Film), and RCC (resin-coated copper).

Figure 2 shows an example of construction of the circuit shown in Fig. 1 on a polyimide substrate. In this example the circuit is mounted on a small, rechargeable Li battery only 7 mm in diameter.

The embedded conductor approach reduces the number of conductor layers required for routing of many circuits, but multi-layer approaches will still be needed for more complex devices. In addition, this relatively new technology must be shown to be environmentally robust and amenable to high production yields. As a first step toward addressing these issues, Potomac is now constructing and testing multilayer daisy chain configurations like that shown in Fig. 3. These incorporate hundreds of conductor links and vias and will be used to investigate production yields associated with fabrication of these elements as well as effects of thermal cycling and flexing.

Fig. 2. LED control circuit fabricated on a polyimide Substrate and mounted on a small Li battery.

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