



Great Start for 2006... a Message from the Director

2006 finds us comfortably residing in our new office space. As our projects reach a level of maturity, there have been many exciting developments. Significant strides have been made in our research with nano-optics. John Rogers received recent national recognition from *Scientific American* for his work. Since June 2005, Education and Outreach has presented 24 programs to middle and high school students, teachers, undergraduates, and graduate students.

The involvement of industry is vital to the success of the Nano-CEMMS Center. Through the development of our affiliates program we are creating a way to accommodate many different types of interests. As a manufacturing paradigm, Nano-CEMMS is processing at the nanoscale in many contexts. We also continually introduce companies to new technology. Affiliates have different needs and relationships with the Center. By joining us as an industry partner, together we can create relationships which will provide the means to explore all possibilities.

Dr. Placid Ferreira
Director, Nano-CEMMS

Nano-CEMMS Industry Advisory Board Meeting

The Center has scheduled our annual Industry Advisory Meeting for March 16, 2006. The meeting's primary objective is to receive meaningful feedback on the Center's current projects and direction as well as ideas for future projects. At the same time, the meeting provides a wonderful opportunity for industry representatives to learn about some of the emerging nanomanufacturing technologies we are developing, meet faculty and student researchers, network with other industry people, and have a hand in shaping the future direction of the Center. This year's meeting will also include presentations from an industry perspective on nanomanufacturing challenges.

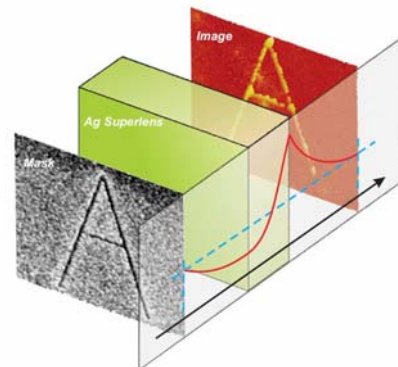
For more information on the meeting and/or if you would like to attend, contact Dave Hamman, dhammon@uiuc.edu, 217.244.8274.

Nano-Optics... at the edge of technology

Professor Nicholas Fang looks for things no one else can see. His work is focused on building nano-optics devices that have potential use in three different aspects.

Imaging

In imaging, the purpose is to observe nano-optics at a subcellular scale. The goal is to use an optical system which allows imaging features with 10-50 nanometers resolution. With this type of resolution there is the potential to see a double strand of DNA clearly or proteins that transport through membranes.



Positioning sensor

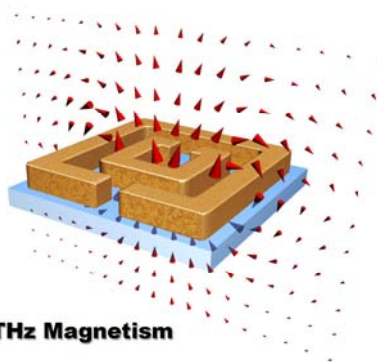
A positioning sensor is basically a nanoscale ruler. The application for nano-optics as positioning sensors is mainly high speed detection. The atomic force microscope, for example, is limited by a mechanical stylus. The advantage of nano-optics is a faster response and no direct contact with parts.

Communication and computing

The third application for nano-optics is communication and computing. To build even faster computers, we need to construct a compact chip which allows more circuits on devices that compute or conduct signals in a small area. Nano-optics has the potential to improve optical fibers by increasing the density of information by 100 times.

To reach the three different applications areas there is a potential barrier—the resolution limit offered by light. The smallest feature that you can see from light is associated with wavelength. Fang works with subwavelengths (feature of dimension smaller than wavelengths) and surface waves (similar to waves on a pond).

Fang states, "In order to overcome current limitations, we need to find a better way to construct optics. And that's the purpose—to find a different approach."



THz Magnetism

Education and Outreach Update

Education and Outreach delivered numerous workshops, camps, programs, and seminars advancing nanotechnology throughout the second half of 2005. Middle and high school students attended Worldwide Youth in Science and Engineering (WYSE) summer camp, Upward Bound, Girls' Adventures in Mathematics, Engineering and Science (G.A.M.E.S.) camp, Destination Technology, WaterTEC Camp, and Discover Engineering. Opportunities for undergraduate students included the summer Research Experience for Undergraduates (REU) Program and Bright Minds. Multiple teacher workshops, a Learning Module Development session, and the Education for Employment System Tech Prep Workshop were held for teachers and educators.





Building for the future. . . the Industry Affiliate Program

The Nano-CEMMS Industry Affiliate Program is designed to involve industry partners in the Center's research activities. Affiliates not only benefit from the technology being developed but also provide input and direction for ongoing and future projects. One of the National Science Foundation's (NSF) goals for Nano-CEMMS is enough industry participation so that the Center will become self-sustaining through direct industry support. NSF urges participating companies to support the Center's human resource development including diversity programs and K-12 and undergraduate education. Nano-CEMMS research is directed toward specific nanoscale tasks that can be integrated into a manufacturing system, but which alone, may have other applications. Benefits of the affiliate program include:

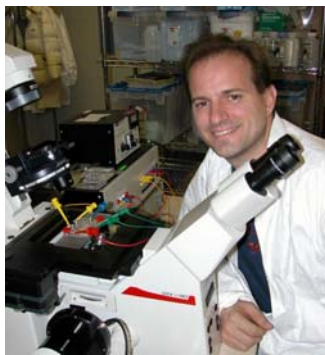
- Personal participation in the Center's developments, research activities, and projects
- Access to advanced technology methods, procedures, equipment, and researchers
- Direct introduction to bright and talented post-doc, grad, and undergrad students
- Tremendous leveraging of R&D spending without University overhead
- Potential to license new technology on a preferred basis
- Use of campus research labs, equipment, and fabrication facilities at reduced rates
- Opportunity to network with other industry researchers
- Support from the Center's education group
- Nominate a representative to sit on the Center's Industrial Advisory Board

David Hamman is the Industrial Programs Coordinator. His mission is to acquaint industry partners with the Center's activities, gain support through the Industry Affiliate Program, and promote collaborative opportunities.

The Center has much to offer industry and few companies know of the technologies being developed through Nano-CEMMS research. There is tremendous potential for both Nano-CEMMS and industry.

The "Lab Guy"

Bruce Flachsbart, Senior Research Engineer, a.k.a. the "Lab Guy", works in the Micro Nano Miniature Systems Laboratory. "It's hectic but it's fun. I love doing this kind of work. I take the idea from paper to something you can hold in your hand." Flachsbart is the first to admit he doesn't come up with ideas; instead, he is responsible for getting processes and equipment to work. And he's good at it. He worries about stickiness, cracking, bridging, and seepage. Much of his work includes sitting down with a team and talking about variables to adjust, running experiments again, and analyzing new results. He knows each new technology is just an enabling tool to make better devices.



Flachsbart has been involved in four major projects for Nano-CEMMS: 1) contact printing of adhesives, 2) temporary carriers for adhesives and for PMMA, 3) etching and patterning PMMA, and 4) imbedded metal layers. He has tweaked hundreds and hundreds of parameters to eventually achieve 80% yields for devices. Flachsbart has been successful getting metal layers to stick and stay and to expand and contract at the same thermal expansion as the polymers.

Flachsbart believes, "It is more than manipulating parameter space, it is being in tune with what your experiments are telling you so you can design another experiment to move towards something usable—to achieve your goal."

Come Visit Our New Location!

During the last week of December, Nano-CEMMS moved into newly-renovated space on the fourth floor of the Mechanical Engineering Laboratory Building on the Urbana-Champaign campus of the University of Illinois. The spectacular new space houses offices for Center administrators, faculty associated with the Center, visiting faculty, administrative staff, post-doctoral and other research visitors, and graduate students. A general reception area houses secretarial staff, a business center, a display area, and a kitchen. A conference room for 25 participants includes an integrated computer audio/visual system and an internet-based teleconferencing system for e-meetings.



Rogers Wins Award

John Rogers, Associate Director for Research for Nano-CEMMS and a professor of materials science and engineering, has been named to the "2005 Scientific American 50," a list of people and organizations whose contributions to science and technology are recognized by *Scientific American*, the nation's premier science magazine.

Rogers was selected as a Chemicals and Materials Research Leader for his research on plastic electronic systems. A profile of his work appeared in the magazine's December 2005 issue under the article, "A Future in Plastics."

For more information:

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