

polymers@RPI



Research, discoveries, and updates from the New York State Center for Polymer Synthesis at Rensselaer

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DIRECTOR'S message

Welcome to the first electronic newsletter from the NYS Center for Polymer Synthesis at Rensselaer. We've moved away from a printed version in order to better reach you, catch your interest, and showcase the outstanding initiatives currently under way. Let me know what you think of our new electronic method of communicating with you. You can provide feedback by e-mail to benice@rpi.edu.

Change is in the air at the center and on campus, bringing with it an array of additions with far-reaching effects as we continue our global impact. On the physical side, work is progressing on the massive multimillion-dollar construction projects on campus that includes the much-heralded Center for Biotechnology and Interdisciplinary Studies. The 218,000-square-foot biotechnology building, scheduled for completion in 2004, will increase research activity and provide a state-of-the-art resource for more than 350 Rensselaer researchers in biotechnology, information technology, and related disciplines. Focus areas of the center will include functional tissue engineering, regenerative medicine, integrated systems biology, bioinformatics, biocatalysis, and metabolic engineering.



Also in the works is a dazzling new center for experimental media and performing arts (dubbed "EMPAC"). Plans for the cutting-edge venue, unveiled in 2003, emphasize the innate connection between technology and the arts, each discipline drawing strength from the other. The center will operate nationally and internationally, offering new and emerging artists, researchers, and audiences a place for creative exploration and collaborative discoveries. Innovative in design, the center will include a theater, black-box studios, artist-in-residence studios, production and post-production facilities, and rehearsal and broadcast facilities, all top of the line. The 203,000-square-foot, \$142 million building is scheduled for completion in 2006.

Construction activity has also been buzzing at Academy Hall, where renovations have transformed the former elementary school into space that allows all student services to be centralized under one roof. And if you're planning to visit campus for an up-close look at the emerging new buildings, you'll be happy to note a new parking garage has been constructed on the south side of campus along College Avenue.

We are also pleased to welcome three new faculty members with interests in polymer research who are invigorating our work here at the polymer center. You'll find them profiled in this issue.

Change is positive, as they say, and we move forward in all our initiatives embracing each new addition.

Brian Benicewicz

*Director, New York State Center
for Polymer Synthesis at Rensselaer*



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Charles E. Reed Lectureship

On Tuesday, **April 20**, Professor James Mark will deliver the 2004 *Charles E. Reed Lectureship* entitled "Some of the Things That Makes Polysiloxanes Fascinating Materials." The lecture is open to the general public and will be held at **4:00 p.m.** on Rensselaer's **Troy campus** in the **Darrin Communications Center, Room 318**.

Professor James Mark

(pictured below) is a member of the chemistry department at the University of Cincinnati. His biography is located at <http://myprofile.cos.com/markj43>



The Charles E. Reed Lectureship was established in 1994 through the efforts of Rensselaer Professor James Crivello and Jon Rich of the GE Corporate Research and Development Center. The first lecture was delivered in 1996. The lecture series honors Charles Reed, a pioneer in chemical engineering who was hailed by his peers for his lifelong contributions to the silicone field (see [Dr. Charles E. Reed](#) for additional details).

CELANESE donation



A consolidation of laboratories at Celanese Ventures USA has reaped great rewards for the Rensselaer polymer center.

Celanese is one of the premiere global chemical companies with a longstanding history of groundbreaking discoveries. Recently, the Celanese fuel cell research laboratory in Summit, N.J., was closed and two large truckloads of equipment were shipped to the polymer center, making the Rensselaer Fuel Cell Test Laboratory one of the most extensive fuel cell test laboratories in the United States. Officials at Celanese estimate the value of the donated electro-chemical and fuel cell test equipment at \$350,000.

"We received the entire laboratory, right down to the beakers and balances," said Brian Benicewicz, director of the NYS Center for Polymer Synthesis at Rensselaer.

"Celanese has supported our fuel cell efforts for years, but this donation reinforces their long-term statement of commitment."

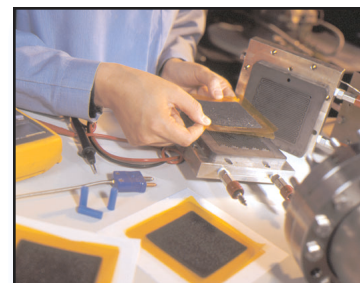
Gordon Calundann, vice president for Celanese Ventures USA, said the donation is just one way the company is supporting the polymer center's research.

"We have provided funds for their fuel cell efforts for years, and I personally go to the campus every few weeks to check out what's going on," said Calundann. "Our company has also hired graduates from Rensselaer and found them to be technically exceptional."

Calundann said a second shipment of valuable equipment is scheduled for 2005, when other geographic changes are scheduled at the company.

"We're building a business with all the research under way at the polymer center, and we're confident Rensselaer will continue to make breakthroughs," said Calundann. "We'll support the center in any way we can."

The new equipment boosts Rensselaer's research on high-temperature polymer membranes and increases to 11 the number of fuel cell test stations in its Fuel Cell Test Laboratory.



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INTERNATIONALLY RENOWNED biochemist joins Rensselaer

Stipulations of Rensselaer's long-term strategic plan call for the hire of "constellations," or groups of top researchers in their respective fields. In support of this goal, Rensselaer welcomes the arrival of **Robert Linhardt** (pictured right) as the Ann and John H. Broadbent Jr. '59 Senior Constellation Professor in Biocatalysis and Metabolic Engineering.

"I hope to combine the current strengths in biocatalysis at Rensselaer with its other existing strengths in bioprocessing, polymer chemistry, nanotechnology, and bioimaging," said Linhardt. "I broadly define biocatalysis to encompass the discovery, design, and engineering of cells and enzymes for applications in developing new processes, materials, and analytical techniques. These are areas that are inherently multidisciplinary, and can have a huge impact in bridging the biological and physical sciences with engineering at the molecular level."

Linhardt's reputation and record are nothing short of extraordinary. With an M.A. and Ph.D. in organic chemistry from Johns Hopkins University and his postdoctoral study completed at MIT, Linhardt to date has published more than 300 research papers and holds 34 patents. He also co-discovered the use of polyanhydrides as drug carriers, which led to the successful clinical application of polyanhydride-based drug delivery agents for the treatment of advanced brain cancer. He has served on the editorial board of *Journal of Biological Chemistry*, *Applied Biochemistry and Biotechnology*, and the *Journal of Carbohydrate Chemistry*. He won the 1994 American Chemical Society's Horace S. Isbell Award, the 1999 Volwiler Research Achievement Award, and the American Chemical Society's highest prize in carbohydrate chemistry, the Claude S. Hudson Award.

Additionally, as the new senior researcher in the Rensselaer constellation, Linhardt's most recent research interest involves a structural analysis of the carbohydrate polymer heparin, a widely used blood anticoagulant. The impact of heparin on daily life cannot be overstated: more than 50 million doses are used across the globe medicinally on an annual basis. Linhardt's research focuses on a new means of synthesizing heparin and investigating its interaction with proteins. His work to date has been instrumental in the FDA approval of low-molecular-weight heparins, an important new class of anticoagulant agents.



Other polyelectrolytes that interest Linhardt include mucins, which are complex glycoconjugates that represent the first line of defense against pathogens. The synthesis of mucins relies on free-radical-based polymerization of charged carbohydrate monomers. The polymers are being explored as microbial barriers, with far-reaching potential impacts on drug development.

Linhardt was accompanied to Rensselaer by most of his research group. Fuming Zhang, his laboratory director, now holds an appointment as a research assistant professor in the Department of Chemical and Biological Engineering. Zhang's interests are in biopolymer interactions in biocatalysis. Sultan Baytas and Eva Munoz are post-doc research associates working on the synthesis and characterization of glycopolymers in the Department of Chemistry and Chemical Biology. Linhardt's group at Rensselaer also includes eight graduate students and a research technician. Peggy Ruggeri has recently joined his group and serves as its chief administrator.

The NYS Center for Polymer Synthesis at Rensselaer welcomes Linhardt and looks forward to his continued research discoveries.

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NEW faculty members

Rahmi Ozisik

Rahmi Ozisik, assistant professor of materials science and engineering, is a recent addition to the faculty at Rensselaer and his research is sustaining a new momentum in the polymer center. Ozisik and his team are at work on the processing, characterization, and modeling of polymeric systems.

Specifically, Ozisik and his group are studying the properties of and behavior on the surfaces of polymeric thin films, nanofibers, and nanoparticles, which are being modeled with the Molecular Dynamics and Monte Carlo methods. Ozisik is working to uncover the static and dynamic properties of polymer chains in the bulk, at the surface, and in highly restricted environments—such as in polymer-carbon nanotube composite systems. His current work is on the plastic deformation of polycarbonate and other glassy polymers.

Ozisik received his Ph.D. in polymer science from the University of Akron. His postdoctoral research was with Ulrich Suter at the Swiss Federal Institute of Technology Zurich.

Ozisik said he was attracted to Rensselaer because of the pioneering work being done on campus.

“When I joined RPI, two centers immediately drew my attention: the polymer center and the nanotechnology center,” said Ozisik. “I was hired as a replacement for Chan Chung, who maintained a laboratory at the polymer center. When I was hired, Professor Chung kindly gave me his laboratory equipment. With it, I’m performing all types of polymer processing-related research activities, such as supercritical fluid processing, gas transport through membranes, and more.”



Sanat Kumar

Sanat Kumar, professor of chemical and biological engineering, is another addition to the Rensselaer faculty. Kumar has several polymer research projects that are being funded by the National Science Foundation and industry grants. One research area is the study of reversibly gelling materials using computer simulations to study the behavior of polymer-based nanocomposite materials.

“Reversibly gelling materials are relevant in a variety of applications, including food, enhanced oil recovery, and properties of other systems,” said Kumar.

Kumar’s research team is also working on phase transitions in thin polymer materials, work that will help define thermophysical properties of polymers in confined geometries, such as paints, lubricants, and adhesives.

“I’ve been at Rensselaer for one year, and I’ve seen the polymer center grow and move forward,” said Kumar. “The center has put us on the map.”