Kenan Center News

The newsletter of the Kenan Center for the Utilization of Carbon Dioxide in Manufacturing
University of North Carolina at Chapel Hill and North Carolina State University

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The Kenan Center for the Utilization of Carbon Dioxide in Manufacturing is a collaboration between the University of North Carolina at Chapel Hill, North Carolina State University, and a team of corporate sponsors. The center seeks to elucidate the fundamental science and engineering principles that facilitate the use of carbon dioxide in conventionally organic and halogenated solvent or aqueous waste stream processes. Areas of research include: *Materials Synthesis and Catalysis*, *Materials Processing, Cleaning and Extractions*, and *Cross-Sectional Areas*. Visit our website at ww2.ncsu.edu/champagne or contact us directly for more information about becoming an industrial partner.

Directors' Letter

". . . we were pleased to find that in most categories, the Kenan Center is doing extremely well."

A recent survey of Kenan Center member companies addressed many different issues regarding the organization and operation of the Center, including research directions, meetings, and collaborations among Center faculty, students and industrial sponsors. This survey was carried out under the direction of Dr. Denis Gray, Professor of Psychology at NC State University, and one of this nation's leading experts on the management of industry-university research programs. For several years now he has helped the National Science Foundation measure the impact of their Industry-University Collabora-

New Industrial Members

The Kenan Center would like to welcome two new corporate industry members: ***Ashland Specialty Chemical Company*** and ***Mitsubishi Rayon Co., Ltd.***

Ashland Specialty Chemical Company is a branch of Ashland Chemical Company that was established in 1967. The company split into Ashland Distribution Co. and Ashland Specialty Chemicals Co. ***Ashland Specialty Chemical Company*** is a leading worldwide supplier of specialty chemicals serving industries including adhesives, automotive, boat building, composites, foundry, merchant marine, paint, paper, plastics, and semiconductor fabrication. Ashland is also so a leader in products and systems for water treatment, fuel treatment, shipboard maintenance, and a program for total energy management.

Mitsubishi Rayon Co., Ltd. was established in 1933 as a manufacture of rayon staple. ***Mitsubishi*** has now grown in to a leading high-value-added specialty polymer chemicals manufacture. The business has now expanded to include synthetic fibers, synthetic resin, carbon fibers, and composite materials, plastic optical fibers and high-performance membranes. Since the merger with Nitto Chemical in 1998 they also have organization in the

Sarah Dalton

Directors' Letter *(cont'd)*

tive Research Centers. As a result, our Center performance could be gauged to those of many other centers across the nation.

Even though the survey responses will be discussed in detail with Center companies during our next review meeting on September 10-11, we were pleased to find that in most categories, the Kenan Center is doing extremely well. However, there is always room for improvement. During the Kenan Center meeting we will be discussing ways of enhancing the quality and quantity of our efforts. We encourage all member companies to join us and to provide their input.

We continue to seek new members in different industrial sectors, and to make progress on individual projects. In addition, our partnership and synergy with the NSF Science and Technology Center for Environmentally Responsible Solvents and Processes is bringing increasing attention to the Kenan Center as a major world focus for industrial outreach in carbon dioxide based technologies. The future looks bright and replete with opportunities. The articles that follow provide a brief glimpse into some of the people, activities and accomplishments that help make our Center so special.

Sincerely,

Ruben G. Carbonell
Co-Director

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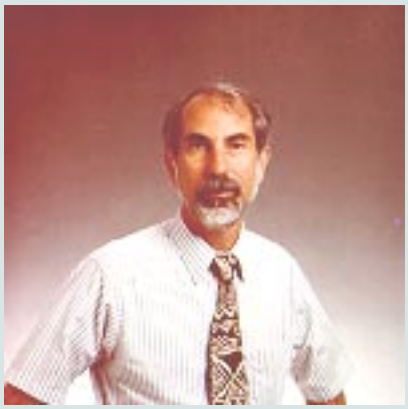
Edward T. Samulski



History:
B.S. (Textile Chemistry), Clemson University, 1965
Ph. D. (Chemistry), Princeton University, 1969
NIH Postdoctoral, University Groningen, The Netherlands, 1970
Postdoctoral, University of Texas at Austin, 1971
Faculty, University of Connecticut, 1972-87
Professor, University of North Carolina at Chapel Hill, 1988

Research:
How (macro)molecules reorient in fluid states (simple liquids, polymer melts, rubber networks, liquid crystalline phases) is fascinating and nuclear magnetic resonance (NMR) gives one an opportunity to infer a detailed picture of the nature of molecular motion—especially how molecular shape and size influences "dynamic packing."

A Specialist in Creativity

Edward Samulski enjoys making obscure connections between seemingly unrelated phenomena in different areas of science. "I get a real high from a new idea — at least until I recognize that it is inherently wrong!" Samulski's career path has somewhat evolved on its own. During his college years, he would compete with his colleagues to see who could take the most hours in a semester. "Back in those days, they did not charge by the credit hour, and if you had reasonable grades, you could take as many courses as you could fit into a schedule. In retrospect, it probably was a little insane to do this — sort of like trying to see how many people you can pack into a Volkswagen." By his senior year, Samulski had enough credits to major in math, chemistry, or several other majors. With advice from a professor, he decided to pursue a graduate degree — a choice that meant he needed to pick a major. "I went to college wanting to major in architecture, but I won a scholarship in the college of textiles. I had little choice in the matter and opted for textile chemistry." When asked about his graduate school experience, Samulski comments, ". . .it was like it is for everyone — very rewarding while sometimes seeming hopelessly impossible. I became convinced I could do a better job teaching than many of my professors!" So, Samulski set his goals on a career in teaching. During his 28 years of teaching, he has been challenged with convincing colleagues in other branches of science that polymers are a legitimate field of scholarly pursuit. Samulski has worked closely with Joe DeSimone on a variety of research topics. He has also collaborated with Charles Johnson, who has been "a wonderful sounding-board for NMR problems. And, it is very exciting to discuss science with Ruben Carbonell. I enjoy the enthusiasm of all of the younger colleagues and students [in the Kenan Center]." A few years ago he was the recipient of the Stone Award presented to him by the North Carolina ACS.

When he's not wearing the hat of researcher or advisor, he's serving as Chair of the Chemistry Department at the University of North Carolina at Chapel Hill (since 1995). As his chair position comes to an end, he comments, "I was always grateful for having students and postdocs stick it out while I was chair. I enjoyed my term as chair and I enjoyed complaining about being chair! Life seems so simple now— just scientific problems to deal with . . . I have lots of ideas and would love to see some of them explored by my students. But there are times when I think I should just go to an island somewhere and paint for the rest of my life — like Paul Gaugin."

-Clarence Murray
3rdYear Chemistry Student

Beyond the Eastman Chemical Patent Donation

UNC-CH and NCSU launched the Carbon Dioxide Patent Assessment, Acquisition and Transfer Initiative (PAATI) in May of 2000 to establish a portfolio of CO_2-related patents through donations from corporations. The initiative represents the first proactive effort from academia to seek Business to University transfer of intellectual property related to an area of core research expertise. PAATI utilizes the engineering, chemistry, law, business, and information science expertise at both universities to identify desirable patents, to develop donation proposals, and to form commercialization plans for donated technology, which may be bundled with homegrown patents for licensing. The Initiative will raise the profile of Business to University technology transfer in scientific and business communities by training students to turn previously idle technologies into viable businesses through the university-based donation and licensing avenues.

UNC-CH and NCSU have agreed to launch this effort with an investment of $371,600 over two years to support an Initiative Director, students, and maintenance fees for patents. Funding has come from private foundations supporting the College of Arts and Sciences and the Kenan-Flagler Business School at UNC-CH, as well as the William R. Kenan Jr. Institute for Engineering, Technology and Science at NCSU. The technology transfer offices at both universities have contributed cash and in-kind contributions. Donating companies may receive tax benefits, or compensation such as preferred access to university research or equity in future time, effort and start-ups. Dr. Gina Stewart directs the new initiative. Summer interns hired from the School of Information and Library Science, the Law School, and from the Kenan-Flagler Business School at UNC have been working on a soon-to-be completed donation from Eastman Chemical Company, as well as scouting other prospective CO_2 technology for donation. For more information, contact Gina Stewart at gstewart@nc.rr.com, or at 919-843-6555.

-Gina Stewart
PATTI Initiative Director

DeSimone Receives Oliver Max Gardner Award

The University of North Carolina Board of Governors named Joe DeSimone the recipient of the 2000 Oliver Max Gardner Award. The award was presented to DeSimone during a meeting of the Board of Governors on May 12, 2000 at the George Watts Hill Alumni Center on the university of North Carolina at Chapel Hill campus Members of the Gardner family were present as well as invited colleagues and friends of Joe DeSimone.

The 2000 Oliver Max Gardner Award recognizes faculty members who have made the greatest contribution to the welfare of the human race during the 2000 scholastic year. It is the oldest and most distinctive statewide honor given to faculty members by the Board of Governors. The award originated from Article VII of the governor Gardner's will, and this is the fifty-second year for which a recipient has been named.

> "During my interview . . . , Edward T. Samuslki described for me his vision in accomplishing [a world-class polymer chemistry program at UNC-CH] . . ."

After being presented with the award by Molly Broad, Desimone addressed the Gardner family and the Board of Governors. During his response he reflected on his interview for an assistant professorship in the chemistry department at UNC-CH. He comments, "During my interview [for assistant professor], Edward T. Samuslki described for me his vision in accomplishing [a world-class polymer chemistry program at UNC-CH] and told me how he and I as ". . . card carrying polymer scientists. . ." would be successful. Well, Ed's vision for our polymer program has led to Carolina's international leadership position in polymer science."

-Darlene Taylor

Molly Broad presents Joe DeSimone with the 2000 Oliver Max Gardner Award during a meeting of the Borad of Governors on May 12,

Films Cast from CO_2 Approach Standards of Microlithography Industry

One of the more recent celebrations of Kenan Center research has been the success of the coatings project. A silicon wafer coated with PFOMA-r-TBM copolymer (without the advantages of a state-of-the-art clean room) displays a film of considerably high quality. The 1 micron thick film was spun cast from liquid CO_2 at 1500 rpm and 610 psi.

Photo by Reto Bolliger

PFOMA-r-TBM film spin cast on silicon wafer from CO_2 at 1500 rpm and 610 psi.

Erik Hoggan: Chemical Engineer at NCSU

Erik Hoggan was born in San Jose, CA but spent most of his life growing up in Colorado. Being the 5th of 6 children born to Jim and Rosalind Hoggan, he was raised to know the importance and value of church and family. He has always enjoyed chemistry and mathematics, and this enjoyment has contributed in part to his decision to become a chemical engineer. He believes that chemical engineering will allow him to apply both chemistry and mathematics to solve hands-on problems. Erik began to first show his ability as a researcher at The University of Colorado at Boulder, when he was named the Undergraduate Researcher of the Year in 1996. During his two years of undergraduate research, he had the opportunity to work with physicists, chemists, chemical engineers (ChE), and electrical engineers. After, receiving his B.S. degree in ChE in 1996, Erik started graduate school at North Carolina State University where he completed his M.S. degree in 1998. The experience Erik gained by collaborating with a diverse group of scientists at the University of Colorado has definitely helped him in his graduate research. Within the Kenan Center, he collaborates with Devin Flowers on the microlithography project. Under the guidance of Ruben Carbonell and Joe DeSimone, Erik has developed a CO_2 spin coater for microlithography. Erik's project has required him to design, build, and refine his CO_2 spin coater to standards comparable to spin coating in organic solvents (see article above). Erik plans to complete his PhD in ChE. from NCSU in the summer of 2001. After graduation, he plans to pursue a career in industry.

He enjoys spending time with wife Julie and their two daughters Emma (6 years old) and Madeline (2 years old). Erik also occupies his time with church activities, hiking, biking, and playing soccer.

-Devin Flowers
3rd year Chemistry Student

History:
B.S. (ChE), The University of Colorado at Boulder, 1996
Undergraduate Researcher of the Year, 1996
M.S., North Carolina State University, 1998
Ph. D., North Carolina State University, proposed date Summer 2001

Kenan Center Project:
Design, build and refine CO_2 spin coater for microlithography

Extracurriular Activies:
Active in church and enjoys spending time with wife Julie and two daughters Emma (6 years old) and Madeline (2 years old)

Fall 2000 Kenan Center Review Meeting

The Bi-Annual Kenan Center Meeting for Fall 2000 will convene on September 10 and 11 at the William and Ida Friday Center for Continuing Education located on Highway 54 in Chapel Hill, North Carolina. The meeting will feature 16 oral presentations (lasting 10 minutes each) given by Kenan Center postdoctorates and graduate students and several posters. Posters will be displayed in the North Atrium of the Friday Center. All presenters are responsible for mounting their posters by 8:30 AM Monday, September 11. CD-ROM discs will be distributed at the meeting containing oral presentations, poster presentations, and abstracts. In addition, industrial representatives will be given folders containing all oral presentations.

Industrial partners are invited to participate in a tour of laboratory facilities at NCSU or UNC-CH as well as Hangers dry cleaning company in Morrisville, NC. Tour guided vans will leave the Carolina Inn at 2:00 PM on September 10. If you plan to participate in the tour, please notify Vicki Haithcock at vph@email.unc.edu before September 5th. Other highlights of the meeting will be a dinner hosted at La Residence, a restaurant located on Rosemary Street in Chapel Hill that specializes in French cuisine. Students are invited to have hors d'oeuvres and interact with industrial representatives during the social hour mixer immediately following dinner at La Residence.

-Darlene Taylor

Tentative Meeting Agenda:

Sunday, September 10, 2000

2:00 PM Tours of Facilities
6:30 PM Dinner (*La Residence*, 202 W. Rosemary St, Chapel Hill)
8:30 PM Social Hour Mixer (*La Residence)*

Monday , September 11, 2000 (*Friday Center*)

8:00 AM Breakfast (*North Atrium*)
8:30 AM Oral Presentations (*Azlea A& B Conference Rooms*)
10:00 AM Break
10:10 AM Oral Presentations (*Azlea A& B Conference Rooms*)
11:40 AM Lunch (*Trillum Room*)
12:30 PM Poster Session (*North Atrium*)
3:00 PM Poster Session Ends

The William and Ida Friday Center for Continuing Education located on Highway 54 in Chapel Hill, North Carolina.

Driving Directions to The Friday Center

From Raleigh and points east

1.Take 1-40 west to Exit 273B for 54-west/Chapel Hill
2.Go west on 54 and at the 3rd stoplight, turn left.
3.The Friday Center will be on your right.

From points west on I-40

1.Take Exit for 15-501 South to Chapel Hill
2.Take bypass 15-501 (landmarks: keep left at the "fork" after Hotel Europa; pass shopping malls and a couple miles of residential and wooded areas)
3.You will just pass over 54 when you see a sign for Raleigh, turn right
4.Go east on 54 and at the 3rd stoplight, turn right
5.The Friday Center will be on your right.

From Pittsboro and points south

1.Go north on 15-501 and take the bypass for 54 East.
2.Exit onto 54 East Raleigh
3.Go east on 54 and at the 3rd stoplight, turn right
4.The Friday Center will be on your right.

Transitions

Several Kenan Center graduate students will be starting their industrial careers or taking new positions within the Center. Terri Carson defended on July 27th and will take a position with Dow Chemical in Houston, Texas. Joe Royer also defended on July 27th and has taken a postdoctorate position in the Center. He will continue to collaborate with Joe DeSimone and Saad Khan on the rheology of polymer melts plasticized by CO_2. Jennifer Young will defend on August 15th. She plans to take a position with DuPont in Delaware. Clay Bunyard will also defend on August 15th, and he plans to take a position with Kimberly Clark in Neenah, Wisconsin starting in October. In addition, several postdoctorates have left the Center to pursue their careers. Dr. Danni Wang (collaborating with Joe DeSimone on monomer partitioning during dispersion polymerizations) has taken a job with Bio-Rad Laboratories in Hercules, California. Dr. Paul Charpentier (formerly working on the continuous polymerization reactor with George Roberts and Joe DeSimone) has taken a faculty position in Canada. Yury Chernyak (a former collaborator with Randall Franklin, Jack Edwards, Richard Gould, Joe DeSimone, and Ruben Carbonell on the RESS Project) has taken a position with Huntsman in Austin, Texas. Finally, our secretarial staff has been in transition. Kathy Zager has relocated with her family to Rochester, New York. Sarah Dalton has been working in the UNC-CH office during the summer months, and she will be returning to UNC-Pembroke for the Fall Semester.

-Darlene Taylor

Looking Back at the Spring 2000 Kenan Center Meeting

Photos by Reto Bolliger

The first Kenan Center Review Meeting of Y2K started on Monday April 24 with a tour of the facilities at NCSU as well as Hangers in Morrisville, NC. In the evening, a dinner at the Carolina Inn was punctuated by the wonderful performance of the *Lorelei*. The Review Meeting continued the next morning at the George Watts Alumni Center. After the introduction of two new Kenan Center members, Thar Designs and Sandia National Laboratories, students and post-doctorates from NCSU and UNC-CH presented their latest research data. A Kenan Center Business Review followed the lunch and the poster session allowed more interactive scientific discussions between industrial partners and researchers. In addition, the poster session was the opportunity for new research groups from UNC-CH and NCSU to expose their work. The Review Meeting ended with a dinner for the External Advisory Board at Joseph DeSimone's residence.

-Stephanie Crette
4th year Chemistry Student

Photos by Reto Bolliger

Clay Bunyard (below) and Stephanie Crette give thier oral presenations.

During the Kenan Center Meeting students gather around the buffet table during a break (top). The light scattering group engages in conversation during the poster session

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