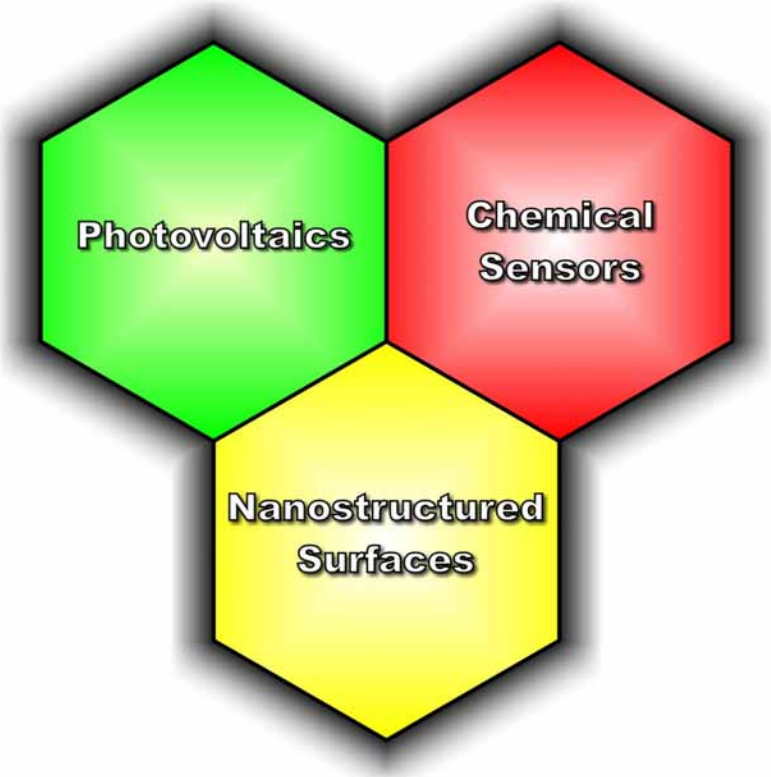
THE MIDLAND CHEMIST
Vol. 45, No. 5 October 2008

64th FALL SCIENTIFIC MEETING

October 24, 2008
11:00 a.m. - 5:00 p.m.
Midland Center for the Arts

Materials for the 21st Century
Keynote Speaker: Prof. Manoj Chaudhury



See the program in this issue of *The Midland Chemist*

See also...

- **SciFest celebrates NCW on October 18,** *pg. 2*
- **Enter a drawing for an Ipod Nano by voting,** *pg. 3*
- **Section receives ChemLuminary awards,** *pp. 5,6*

THE MIDLAND CHEMIST

Volume 45, Number 5
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American Chemical Society
Midland Section
PO Box 2695
Midland, MI 48641-2695
http://membership.acs.org/M/Midl

Volunteer Staff

Ann F. Birch ..... Editor
989-832-7485
ann.birch@editech-mi.com
Dave Baker ..... Writer
Peggy Hill ..... Writer
James R. Birch ..... Design, layout

Please submit all articles and photographs to the editor, Ann Birch. Instructions for article submission are on the Midland Section web site, as is contact information for other staff members. Authors can also contact Ann directly with any questions.

Neither *The Midland Chemist*, nor the Midland Section, nor the American Chemical Society assumes any responsibility for the statements and opinions advanced by contributors of or to *The Midland Chemist*.

From the Chair

Fall Events Are Almost Here

Dorie Yontz, Chair
ACS Midland Section

Fall is here and we are approaching the end of the year. Mother Nature is getting ready for a period of dormancy, but the Midland Local Section is still going strong. We have had quite a busy year, and some of our biggest events are yet to come.

On Saturday, October 18, we will hold our annual SciFest in celebration of National Chemistry Week. The theme for this year is "Having a Ball with Chemistry." SciFest is a community event designed to show the importance of chemistry in our lives. If you're looking for a way to share your love of science with the whole family or if you just want an interesting way to spend a couple of hours on a Saturday, please join us. Also, we need volunteers to help with the demos and with refreshments, so if you or your family is interested in helping, please let us know.

Our annual Fall Scientific Meeting will be Friday, October 24. This year's theme is "Materials for the 21st Century" and will feature symposia onphotovoltaics, chemical sensors, and nanostructured surfaces. Professor Manoj K. Chaudhury of Lehigh University will be our keynote speaker. ACS members throughout the MidMichigan region will present posters of their research. This is a great way to gain a fresh perspective through dialogue with scientists from the five counties that make up the Midland Section. This is our most significant event for our members, so please join us if you can.

Lastly, fall is the season when we elect our officials for the upcoming year. A big thank you to those of you who have agreed to run for an office. Our volunteers are the lifeblood of our organization and are vital for our continued success. We have a great slate of candidates and I'd like to acknowledge Kevin Lewis, chair of our Nominations and Election Committee, for his hard work in recruiting our candidates.

Dorie J. Yontz

2008 SciFest Promises "You'll Have a Ball!"

By Dave Stickles and Joan Sabourin

Join us for a celebration of National Chemistry Week at SciFest 2008: "Having a Ball with Chemistry." The event will be held at the Delta College Pioneer Gym from 10:30 am to 2:30 p.m., Saturday, October 18, 2008. Admission is free with lots of activities for families and individuals!

This year's goals:

1. Enhance the understanding of materials, design, and safety improvements of sports/sporting equipment made possible through chemistry.
2. Stress the importance of hydration and good nutrition for athletes.
3. Help develop an understanding of the importance of an active lifestyle for physical well-being.
4. Encourage participants with booths to have a "Chemistry Olympics" with hands-on activities with stations for questions or other challenges.
5. Provide activities for participants conducted by members of various local teams and health centers.

The organizing committee encourages you to join in the fun, not only by attending, but also through sharing your knowledge and activities involving the above goals with a booth and activity or as general volunteers. For additional information, call Dave Stickles (989-496-3273), Joan Sabourin (989-686-9250) or Angelo Cassar or Gretchen Kohl (989-631-7128).

Volunteers are needed

from 9:00 – 10:30 a.m. for set up
from 10:30 a.m. – 12:30 p.m. for science demo tables and food table
from 12:30 – 2:30 p.m. for science demo tables and food table
from 2:30 – 3:30 p.m. for tear down

Volunteer Opportunity

Dow Public Affairs is asking members of the Midland Section if they can help with the Halloween Harvest at the Saginaw Children's Zoo by providing science demos and other volunteer activities. The dates are below. Please contact Holly Swanson (hjswanson@dow.com) to volunteer or for more information. There are 1500 tickets sold for each night for a total of 4500 people who can potentially come through.

Friday and Saturday October 24 and 25	Sunday, October 26
4–8 p.m.	3–7 p.m.
Set-up 3–4 p.m.	Set-up 2–3 p.m.

Votes Needed!! *Win an Ipod Nano!!*

By Dee Strand

In October, Midland Section members will receive a separate mailing containing election information. The mailing will include a list of candidates for 2009 Section offices along with biographical information, information on a proposed change to the Section by-laws (also described below), the ballot, and the required envelopes for voting. In the past, election information and the ballot have been included in the October issue of The Midland Chemist. However, by mailing election information separately we hope to emphasize the importance of voting and encourage all members to vote. We've also made things a bit easier by pre-stamping the return envelope. No need to purchase a stamp! So look for this package in your mail in the next week or so. And, last but not least, every member who returns a ballot will be entered in a drawing for an Ipod Nano. SO MAIL IT IN!!

The Board of Directors of the Midland ACS local section would like to make some important changes in our by-laws. This could enable activities such as on-line voting, and also reflect more accurately how our section operates. However, in order to change our by-laws, we need to have 30% of our section members cast a ballot. The by-law change is approved if 67% of those 30% are in favor. If fewer than 30% of the section members cast a vote or if less than 67% approve, the by-law change is rejected.

The first by-law for which we would like to propose a change involves how the section amends by-laws. Current and proposed verbiage are shown below. The proposed by-law change would allow by-laws to be amended with a 2/3 majority of those who cast their ballot, with no restriction on what fraction of the section votes. This is consistent with many other local sections across the country. Amendment of this by-law will allow us to make future, necessary changes more easily. Typically, about 15% of section members cast ballots, which makes it very difficult to ever update our section by-laws.

BYLAW XI – AMENDMENTS

Current

"A proposed amendment to these bylaws must first be submitted to the Board of Directors. If it is approved by a majority of the Board, it shall be prepared for balloting. A proposed amendment which is not approved by the Board shall be placed on the ballot upon receipt by the Secretary of a petition for such action signed by 50 or more members of the Section. Balloting shall be in the same manner as provided elsewhere in these bylaws.

If 30% of the members cast valid ballots and if 67% or more of the votes cast are favorable, the bylaws shall be amended accordingly. Such amendment shall become effective upon approval by the Committee on Constitution and Bylaws acting for the Council of the SOCIETY, unless a later date is specified."

Proposed

"A proposed amendment to these bylaws must first be submitted to the Board of Directors. If it is approved by a majority of the Board, it shall be prepared for balloting. A proposed amendment which is not approved by the Board shall be placed on the ballot upon receipt by the Secretary of a petition for such action signed by 50 or more members of the Section. *A proposed amendment must be published in the Local Section publication at least one month prior to balloting.* Balloting shall be in the same manner as provided elsewhere in these bylaws. *If 67% or more of the votes cast are favorable, the bylaws shall be amended accordingly.* Such amendment shall become effective upon approval by the *National* Committee on Constitution and Bylaws acting for the Council of the SOCIETY, unless a later date is specified."

Why Take an ACS Webcast Short Course?

From National ACS

Few companies are immune from the economic hardships in the headlines and many budgets have been trimmed. But it is still crucial to your career to engage in continuing education to expand your skills and stay abreast of new topics. So save your time and money and take a look at the courses available online through the American Chemical Society. ACS offers a wide variety of webcast short courses and our fall schedule is open for registration now.

- **In-Depth Personal Attention** – The average class has 12 participants, and our instructors are available by email in-between sessions.
- **Interactive** – We've chosen a great technology that allows you to participate just as in a live class; you can even write on the whiteboard.
- **Ready when you are** – If you miss a session, it's okay. All class sessions are recorded and ready for viewing when you're available.
- **More Application Time** – Instead of getting all the information in a few days, you have time between sessions to apply what you've learned.

There are expanded course offerings in analytical, organic, pharmacology, engineering, instrumentation, and other areas. For the full list of Webcast Short Courses visit www.acs.org/webcourses.

Councilor's Report from National Meeting

By Bob Howell

The 236th national meeting of the American Chemical Society was held August 15–21, 2008, in Philadelphia. The meeting attracted 13,800 total attendees: 8,196 regular registrants, 3,087 students, 481 guests, 546 exhibit only, and 1,430 exhibitors. The exposition contained 511 booths representing 357 exhibits (a national meeting record). Exhibitors presented 15 workshops. The Jobs Center was active with 80 employers (125 employer representatives) posting 256 available jobs. Vying for the available positions were 1074 job seekers.

As usual several committees met at this meeting (most of the work of ACS gets done by committees). The Patents and Related Matters Committee (CPRM) met on Saturday, August 16. A major item of discussion was pending reform of several patent laws/regulations. This reform was stalled in the last Congress but appears to have a better chance of passage in the next Congress (a non-election year). CPRM prepared a policy statement on patent reform for review by the ACS Board of Directors and subsequent use by the Office of Legislative and Government Affairs (OLGA) in discussions with key members of Congress.

The awards subcommittee of CPRM prepares nominations for inclusion in the National Inventor's Hall of Fame, the National Women's Hall of Fame and for the National Technology Medal as well as the National Medal of Science. I'm sure that the Midland Section-ACS is home for many deserving individuals. Should you know of such people and are willing to assist in preparing a nomination please let me know.

The committee on Nomenclature, Terminology, and Symbols met on Monday. A major point of interest continues to be the re-definition of the kilogram based on Planck's constant. This means that all fundamental qualities will now be based on some physical property and will be free of dependence on artifacts of any kind. It also means that the mole will now be a secondary unit and will be independent of the mass of any quantity of any element. A symposium on nanoscience nomenclature will be held at the spring Salt Lake City meeting.

The PolyEd Committee met on Tuesday morning. A major item of discussion was the means by which elements of polymer science are to be included in the undergraduate chemistry curriculum. The Polymer Division, the Division of Polymeric Materials, and the Rubber Division are three of the largest divisions within ACS yet the subject matter base for these divisions has largely been ignored by the ACS Committee on Professional

Training which sets certification criteria. It is hoped that ACS President-Elect Tom Lane, who is a prominent figure at a major materials-based company, will have a positive influence on this situation.

The ChemLuminary awards event was held on Tuesday evening. The Midland Section-ACS was nominated for seven awards. This reflects the excellence of many Midland Section activities and the hard work of individuals who make them happen. Special thanks must go to Dee Strand who prepared the 2007 annual report which provided the basis for nominations and Gretchen Kohl who prepared the poster which presented the activities responsible for the nominations. The poster was displayed prior to the awards program and received many positive comments. In particular, several individuals were enthusiastically interested in the teacher outreach activities directed by John Blizzard. The Midland Section received two awards. One of these was for Outstanding Performance by a Local Section

Bob Howell, Midland Section Councilor, poses with one of the ChemLuminary awards received by the Section. On his left is Wayne E. Jones, Jr., chair of the Local Section Activities Committee, and on the right is Katie Hunt, past-president of ACS.

in the medium-sized category (for the third year in a row!). The other was Outstanding Event for the General Public Using the Yearly Theme for our Earth Day activities. Everyone involved can take considerable pride in these achievements. Well done all.

The Council, as usual, met on Wednesday morning. Several items of note (and some of lesser note) can be reported. President-Elect Tom Lane was a prominent member of the governing dais. He already has presidential events planned for Salt Lake City and is closing in on those for the fall meeting in Washington. A revised division funding formula which improves clarity, offers simplicity, and rewards collaborative programming between divisions was approved. Society affiliate dues were set equivalent to member dues. The registration fee for national meetings was increased by $10 to $340 for 2009. More than 12,000 individuals have joined the ACS member network. ACS membership remains strong and the Member-Get-a-Member program is well on the way to a record year. In 2007 a total of 1559 new paid members were obtained *via* this route. Already this year there are 988 new paid member applications. A new Division of Catalysis Science and Technology was granted probationary status.

At this meeting Project SEED was celebrating its 40th anniversary. Over 100 Project SEED students presented posters describing their research. Stipends for SEED students were increased to $3,000 for SEED I and $3,500 for SEED II. The divisions of Agricultural and Food Chemistry, Industrial and Engineering Chemistry, Organic Chemistry, and Physical Chemistry are all celebrating a 100th anniversary this year. So too is the American Institute of Chemical Engineers (AIChE), which was founded as a division of ACS. The ACS Board has approved an alliance with the Royal Society of Chemistry with a theme of Research in Chemistry for Society/Sustainability (RICHES). A special discussion item at Council was Achieving Sustainability (Energy, Water, Food). This is one of the major challenges facing the world – a rapidly expanding (and perhaps too large) world population and large, rapidly developing nations consuming resources at a hugely increasing rate. ACS finances remain stable with a $24,000 favorable variance to the approved budget. However, this is balanced by a loss of similar size on investment income. A focused interest group task force has been established to address the formation of groups of special, chemistry-based interests outside, rather than within, the ACS.

A C-o-o-o-l Summer for MMTG

By Dana Fuerst, MMTG Chair

Mid-Michigan Technician Group (MMTG) members cooled off at the beginning of the summer at the Tri-City Brewing Company tour and membership drive and relaxed until the ACS Professionals Day at the Midland County Fair on August 14. Several MMTG members volunteered at the event. If you attended, there is a good chance you saw one of them.

Our chair eect, Gerard Nowaczyk, wrapped up his summer by attending the Fall National ACS meeting in Philadelphia. He attended several of the leadership training workshops offered, as well as the Division of Chemical Technicians (TECH) Leadership Training for Technician Affiliate Groups (TAGs). He was also able to build a network at the National ACS level and enjoy some down time with the group (just ask to see some pictures!).

Now that summer is over, it's time to get back to business. You can expect to see MMTG members working at the science demo booth at SciFest 2008 at Delta College on Saturday, October 18. You will also see us at the Fall Scientific Meeting on Friday, October 24, as we present our "MMTG in 2007" poster. I encourage you to stop by to see what we did in 2007 that helped us win the "Best Local Section/TAG Interaction" award from TECH.

We are in full swing of planning the Career Development Talk that is being held at Delta College on Wednesday, October 29. This event is being paid for by the funds received from the Equipping the 2015 Chemical Technology Workforce grant from the National ACS and will feature Dave Gantner of Dow Corning and Curt Theriault of Dow Chemical. Seating is *very* limited for this event and an RSVP is required. To RSVP or for more information, please contact Dana Fuerst at dfuerst@dow.com

We are also beginning to plan our annual Year-End Member Appreciation/Meet the 2009 Board Lunch. The tentative date is Tuesday, December 9, so mark your calendar now! The location has yet to be determined but you can bet that it will involve some tasty food and a few good laughs!

MMTG is currently accepting nominations for our annual elections. If you think you may be interested in becoming involved in our award-winning TAG, please don't hesitate to contact Dana Fuerst.

S*M*A*R*T Mentoring Program Starts Another Year

By Christine Brillhart

Editor's Note: Although readers may not receive this issue in time for the reply deadline, we encourage anyone interested in the program to contact Christine as soon as possible if they would like more information or would like to attend the informational meeting.

We appreciate the time that ACS members have spent with the S*M*A*R*T (Science & Math Academic Resources Team) mentoring program and want to inform you of opportunities for this year. We are continuing parts of the program at Northeast Middle School and are fortunate to include another math class from Central Middle School. Mentoring can offer great rewarding experiences.

District Update

There are new volunteer procedures from Midland Public Schools that you will receive at the informational meeting. Christine Brillhart will still coordinate the program paperwork and make sure communication and the details are arranged. The teachers will provide weekly lessons on what the plan is for your time in the classroom.

The state has also mandated four years of math for high school graduation. Your help at the middle school level is needed more than ever!

We have an aggressive deadline to start right after the State's MEAP testing period. The goal is to have mentors placed in the classrooms the week of October 20th.

Due to some of these major changes, we are asking for you to attend this informational meeting to meet the teachers, fill out district volunteer forms, receive an update on the district's volunteer requirements and policies, and answer any questions you may have about the program.

Informational Meeting *Required*

October 7, Tuesday 4:00–5:00 p.m. Northeast MS location TBD

Contact Information

Please e-mail Christine (brillhartcc@gmail.com) the following information:

Name:
Email:
Have you mentored in this program before?
Other mentoring experience?
Are you a member of American Chemical Society?

With your help, we aim to aid students in both their understanding of skills and concepts and promote interest in math and science through some of the following options:

Mentoring Opportunities

10:30–11:00 a.m. Tuesday
10:30–11:00 a.m. Wednesday
(two different classes)
6th Grade Math Lab (Mr. Brown at Northeast Middle School)
Number of students – 22 Tues and 21 Wed
Mentors are needed to assist students in their basic math skills and concepts. Students will be assigned a mentor in small groups to reinforce the math basics while engaging in activities.

11:35 a.m.–12:30 p.m. Wednesdays
6th Grade Math class (Mrs. Deb Smith at Central Middle School)
Number of students: 26
Mentors are needed to assist students in their basic math skills, focus on vocabulary and concepts. Students will be assigned a mentor in small groups to reinforce math skills.

12:15–1:15 p.m. Wednesdays
6th Grade LD Math Class (Mrs. Brigit Sova at Northeast Middle School)
Number of students: 11
Mentors are needed to assist students in their basic math skills and concepts. Students will be assigned an individual mentor for specific math areas to focus on and strengthen.

3:00–5:00 p.m. Once a week; will establish with coaches; flexible
Science Olympiad Coaches (Ms. Christiansen and Mrs. Brillhart at Northeast Middle School)
Number of students: will vary about 10–30
Science Olympiad is a state-wide science competition. There are 23 events that involve some area of science. Students will have the opportunity to design, construct, modify, explore, and research specific topics in science. We need at least 10 assistant coaches to specialize in varying events. Each mentor/assistant coach will work with 2 to 5 students to help them prepare for the district and state competition.

For NEW Mentors

We are requesting that all NEW mentors come to one training session to learn more about the program, get information on the class they have volun-

teered to work with, remember what middle school is like, go through some of the exercises planned, and fill out an interest survey used to match mentors to students.

Training Times:

Oct. 7, Tuesday 5:00–6:00 p.m. New Mentor Training
Northeast Middle School location TBD

Oct. 8, Wednesday 4:00–5:00 p.m. New Mentor Training
Northeast Middle School Science Labs

I am so proud of everything that was accomplished last year! We are growing and will continue to refine and develop this program and the math attitudes and confidence in these young minds. I am always open to any suggestions you have to provide a more effective and successful program. Please respond by Friday October 3 to brillhartcc@gmail.com.

A confirmation reminder will be sent to you and more details. Thank you again for valuing student progress.

Eli Lilly/WCC Travel Award

From National ACS

Eli Lilly and Company and the American Chemical Society (ACS) Women Chemists Committee (WCC) sponsor a program to provide funding for undergraduate, graduate, and postdoctoral women chemists to travel to ACS meetings to present the results of their research. Through this program, Eli Lilly and Company and WCC continue to increase the participation of women in the chemical sciences. Please submit your application by February 15, 2009 for travel between July 1 and December 31, 2009. For additional information please go to www.acs.org/diversity > Awards & Recognition > Eli Lilly/WCC Travel Award.

Professionals Day Celebrated at County Fair

By Jennifer Dingman

The Midland Section of the ACS, with the help of the MMTG and YCC, hosted its annual Professionals Day at the Midland County Fair on Thursday August 16. The event was held in the Brown Picnic Building on the north end of the fairgrounds next to the grandstand. It was a gorgeous day to be at the fair…except for the huge thunderstorm which drove the people inside for about 30 minutes! It was standing room only while members and their families were provided with free drinks, hot dogs, popcorn, and sno-cones in addition to live science demonstrations for the kids. Midland County Fairgrounds graciously provided our members with a discounted "VIP ride bracelet" for unlimited ride access for 9 fun-filled hours and we had over 210 people take advantage of that deal. It was estimated that the event was visited by over 500 people during the course of the 3.5 hour event. We beat the attendance record from 2007 and we hope to continue to increase attendance, so mark your calendars now for next year's event which will be August 15, 2009, same time, same place.

Thank you to all the members who attended and a special thanks goes out to the volunteers who helped put the event together. An event like this could not have been pulled off without the time and energy of volunteers, and we would like to thank those people formally here. In a time where no one seems to have a free minute, these folks took hours out of their schedules to help out with this event.

Bill Warren	Mike Ferritto	Bob Oldinski
Debra Mendrick	Grant Thomas	Liz Smith
Hobart Barker	Lena Nguyen	Sue Perz
Paul Popa	Kelly Doede	

Until next year... See you at the fair!!

SVSU Engineering Hosts Open House

By Eldon Graham

Tours of the newly remodeled engineering laboratories at Saginaw Valley State University start at 10:00 a.m. on Saturday, October 11, in Pioneer Hall. Visit the SVSU web-site for a campus map (www.svsu.edu).

There will be student project displays and a lecture and discussion on global energy concerns at 11:00 a.m. The lecture is arranged by the Society of Automotive Engineers and the Saginaw Valley Engineering Council (of which the Midland Section ACS is a member).

"Energy: Technologies and Global Outlook"
Dr. John L. Gardon
(Former Vice-President and Research Director of AKZO Nobel Coatings Co.; Chairman of Polymeric Materials, Science and Engineering Division, American Chemical Society)
SVSU, Pioneer Hall, Room 240, 11:00 a.m.

The presentation will cover the following topics:

- Greenhouse and toxic gas emissions; global warming.
- Our dependence on Middle Eastern fossil fuels.
- Other sources of energy such as solar, wind, nuclear and hydro.
- Electric cars, plug-in hybrids, fuel cells, etc.
- Global policies.

For further information, contact Eldon Graham at SVSU, 989-964-4127.

ACS Careers Industry Forum

Teleconferences Feature Luminaries in the Chemical Sciences

From National ACS

We are working hard to keep you up-to-date on cutting edge industrial issues affecting your current and future employment needs. Make informed decisions about your career and take control of your career path.

Please join us on the 2nd Thursday of each month from 2 to 3 pm to discuss economic and employment trends with top industry executives in the chemical sciences. Register now at www.acs.org/careers.

This is a free service via conference call. Check us out for future new and innovative career services programs. We want to hear from you; please post comments on our blog at www.acs.org/careers.

Fall 2008 ACS Tour Speaker Seminar

A Chemist's View of Flavors

Tom Parliment
Dow Science Building Room 170
Central Michigan University
Nov. 17, 2008; 4:00–5:00 p.m.

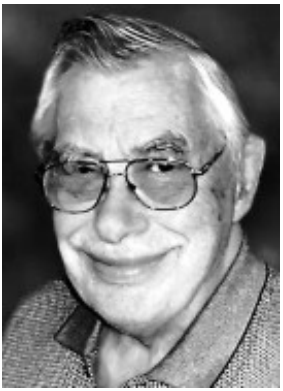
Abstract: The aromas of food products are quite complex with typically hundreds of volatile components present. This talk will discuss the origin of compounds found in aromas and will cover the contribution of these chemicals to the overall character of a food. Examples of interesting aroma chemicals will be presented. The aromatic composition of selected foods will be discussed in deatil and used to demonstrate how aroma research is conducted.

Biographical Sketch: Tom Parliment is a flavor chemist who received a BS degree in chemistry from Lehigh University and a Ph.D. in food science from the University of Massachusetts. In his career with General Foods and Kraft Foods, he studied the aromatic composition of numerous foods such as meat, coffee, baked goods, seafood, fruits, andcheese, and he has more than 20 patents and 50 publications in these and related areas. He is a member of a number of professional societies, including the American Chemical Society (ACS), Sigma XI, and the New York Institute of Food Technology. Tom is past chairman of the New York Chromatography Society, the Flavor Subdivision of the ACS, and the Rockland Chemical Society. He is the co-organizer of four national American Chemical Society symposia, covering biologically and thermally derived aromas. He has co-edited four flavor-related books. Since retiring from Kraft, he has been a consultant to the flavor industry.

In Memoriam

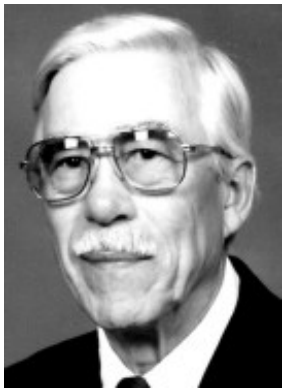
Adapted with permission from the Midland Daily News and the Midland Center for the Arts

Rodney A. Nelson



Rodney A. Nelson, an ACS member since 1961, died January 26, 2008. He was born on January 4, 1928, in Granite Falls, MN. Rodney attended schools in Minnesota, graduating from high school there and graduating from the University of Minnesota with a bachelor's degree in business administration, a bachelor's degree in chemical engineering, and a PhD. in chemical engineering. He was a scientist in research for the Michigan Division and Central Research of The Dow Chemical Co. He retired from Dow in 1987 after 30 years of employment. He enjoyed math and science and helping others in the scientific community. Rod was a member of the First Baptist Church, serving as auditor and member of the Stephen Ministry. He was active in Cub Scouts and Boy Scouts. He enjoyed his membership in the Free Radicals Investment Group for many years. His other interests included canoeing, backpacking, photography, and his great love for the woodlands. He married the former Corinne Hein on August 2, 1952, in Maynard, MN. Corinne survives him along with two sons and one daughter.

John Cobler



John Cobler, a member of ACS for 66 years, died April 16, 2008. He married Ruth Mae Mikel on June 14, 1941, in Wooster, Ohio. Ruth M. predeceased him on January 14, 1989. His second wife, Ruth E. (Kalat) Cobler, survives him, as do two daughters.

After graduating from Wooster College, Wooster, Ohio, in 1940, he transferred to the University of Rochester, and joined the staff of the Manhattan Project under a Government War Contract. In 1945, he joined the Borden Co. where he worked until joining The Dow Chemical Co. as a chemist in the analytical laboratory in 1949. He started the Polymer Analysis Laboratory in 1953 and

was responsible for the analytical health safety aspects of Dow's food additives and plastic packaging materials. He was named technical expert in 1959 and associate scientist in 1969. In 1975 he joined Health and Environmental Research in the Government Registration Group and played an active role in the development of the Food and Drug Administration's original 1966 Guidelines. He authored or coauthored 30 articles in various trade journals and chapters in four reference books. He was a member of the Scientific Research Society of America, the New York Academy of Sciences, the American Chemical Society, the American Society for Testing and Materials, and the Society of the Plastics Industry. He was the recipient of ASTM's Award of Merit and title of Fellow of the Society. The Society presented him with a certificate in Recognition of Leadership and Technical Innovations. He was an emeritus member of the American Chemical Society.

John retired from Dow in 1984 after 34 years of service, but was retained as a consultant to the Government Registration Group for several more years. He was active in Boy Scouting as an Eagle Scout merit badge counselor and on the Paul Bunyan Council. He taught high school chemistry/adult education for several years. John was also active in the music program in Midland along with a number of other church and community activities. He was a serious woodcarver whose songbirds and decorative duck carvings have traveled around the United States, Canada, England and Japan over his "Feathers of Wood" signature.

Edward Flagg

Edward Earl Flagg, 74, of Midland died Sunday, August 31, 2008. He had been a member of ACS since 1960. Edward grew up in Memphis, Tennessee. He had an AB from Harvard University, an MA in inorganic chemistry from Purdue University, a Ph.D. in inorganic chemistry from Saint Louis University, and an MBA from Central Michigan University. He also served two years in the army and taught one year at Lemoyne College in Memphis. In 1964, he was hired by The Dow Chemical Company. This began a 27-year career with Dow, primarily as a research chemist. He authored several patents and scientific publications.

Edward was active in the Midland community. He was an officer and president of Midland Toastmasters, an officer and president of the Kiwassee Kiwanis Club, and lt. governor of Division 19 of Kiwanis in Michigan. He served most recently with the AARP's Tax Counseling for the Elderly and the Kiwanis monthly program on MCTV.

In Past Issues of *The Midland Chemist*

By Wendell L. Dilling, Midland Section Historian

- **40 Years Ago This Month**—In *The Chairman's Column* by D. A. Rausch: "In 1969, our Section is again entitled to four Councilors to represent the Section at the Council Meetings of the American Chemical Society. The number of Councilors each section is allowed is determined by the number of members in the section. For the past several years, our Section has missed having a fourth Councilor by only ten to twenty members. If the Midland Section does not continue to grow at the same rate as it has during the past several years, we will probably be entitled to only three Councilors again in 1970."
- **30 Years Ago This Month**—In *1978 ACS Fall Scientific Meeting* by the General Chairman: "A subtheme of the meeting deals with alternate energy sources. Persons attending the Friday evening combined Annual Midland Section Guest Night – Fall Scientific Meeting Speaker's Banquet will hear Mr. Paul Maycock, Assistant Director for Photovoltaics, U.S. Department of Energy, speak on 'Solar Energy – Ready When You Are'. Saturday morning's program will include the symposia, Solar Energy and Oil Shale, and an exhibit on energy from wood chips."
- **20 Years Ago This Month**—In *Chairman's Column* by Billy M. Williams: "Last year, on National Chemistry Day, the Midland Section sent nearly seventy of you into the field to share with area students the wonders of science. This qualified as one of our most successful events ever for membership involvement, enthusiasm displayed and pure fun. We want to duplicate the excitement, enthusiasm and involvement for 1989. Planning for our 1989 National Chemistry Week activities will soon be underway."
- **10 Years Ago This Month**—In *Good Day, Chemists!* by Art Smith: "Our Midland Section has over the years gotten a real reputation for doing an outstanding job in the area of chemical education particularly in training science teachers at the elementary and secondary levels – i.e., conducting workshops and generating original resources for teachers who too often lack an adequate background for teaching science to kids at the beginning of their educational experience. These efforts have been carried out by people like John Blizzard and Gretchen Kohl and others who are the driving forces in our Section's National Chemistry Week and Science Literacy programs. In point of fact, at the National Meeting in Boston last month they were presented with a special Phoenix Award in recognition of their extraordinary and creative efforts in this regard."

Program for the 64th Fall Scientific Meeting

Friday, October 24, 2008
11:00 a.m.–5:00 p.m.
Midland Center for the Arts

Note: For the most up-to-date program go to the Midland Section website (http://membership.acs.org/m/midl/) and click on the link for FSM Program.

Materials for the 21st Century

The Midland Section of the American Chemical Society would like to invite you to attend the 64th Fall Scientific Meeting. The theme for this year's FSM is "Materials for the 21st Century," emphasizing photovoltaics, chemical sensors, and nanostructured surfaces. The three co-chairs of the meeting are Petar Dvornic, Senior Research Scientist and Professor of Polymer Chemistry at Michigan Molecular Institute; Mustafa Mohamed, Senior Chemist at Dow Corning Corporation; and Mike Owen, Dow Corning Scientist Emeritus and Adjunct Professor MMI. The meeting will be held at the Midland Center for the Arts beginning with lunch at 11:00 a.m. followed by a welcome and awards presentation at noon and the keynote address.

Professor Manoj K. Chaudhury, Franklin J. Howes Distinguished Professor at Lehigh University, will be giving the keynote address on "Surface Modification of Organic and Inorganic Materials." Dr. Chaudhury spent part of his career in Dow Corning R&D in Midland. He is the recipient of the ACS V. K. LaMer Award, the Herbert D. Doan award for Excellence in Research, and the Adhesion Society award for Excellence in Adhesion Science. Among his collaborations/consultancies are Boeing, Dow Chemical, and the National Starch and Chemical Co.

A poster session from 2:00 to 3:00 p.m. will provide participants with an overview of research being conducted by a variety of institutions in the Mid-Michigan area. Dow Corning is sponsoring a $500 prize for the best undergraduate poster.

The poster session will be followed by three mini-symposia on the specific topics of photovoltaics, chemical sensors, and nanostructured surfaces. There will also be a vendor exposition throughout the afternoon.

After the meeting, a social hour will be offered to meeting attendees at Oscar's Restaurant in Midland. Later in the evening, a banquet will be held for speakers and FSM committee members at D'Alessandro Villa. A schedule is given below with details following on keynote address, awards, symposia, and posters. Come and join us!

Mike Owen, 989-631-7339, michaelowen01@chartermi.net
Petar Dvornic, 989-832-5555 x550, dvornic@mmi.org
Mustafa Mohamed, 989-496-7024, mustafa.mohamed@dowcorning.com

2008 ACS FSM Committee Volunteers

Co-Chairs	Mike Owen, Petar Dvornic, Mustafa Mohamed
Keynote Speaker	Mike Owen
Program	Petar Dvornic, Mustafa Mohamed
Registration	Dale LeCaptain
Vendors	Brett Zimmerman, Eric Joffre
Posters	Brad Fahlman, Joel Kern
Publicity	Pankaj Gupta, Anne Kelly-Rowley
Programs, Website	Ann Birch
Photovoltaics symposium	Ethan Good
Chemical sensors symposium	Steve Keinath
Nanostructured surfaces symposium	Mustafa Mohamed

Schedule and Locations

Time	**Event**	**Location**
11:30 a.m.–3:00 p.m.	Registration	Brick Lobby
11:00 a.m.–12:00 p.m.	Lunch	Garden Room
12:00–12:45 p.m.	Welcome/Awards	Little Theatre
12:45–1:45 p.m.	Keynote Presentation	Little Theatre
1:45–2:00 p.m.	Break	
2:00–3:00 p.m.	Posters/Vendor Exposition	Brick Lobby
3:00–5:00 p.m.	Photovoltaics	Little Theater
	Chemical Sensors	Lecture Room
	Nanostructured Surfaces	Founders Room
5:15–6:30 p.m.	Meeting Social	Oscar's Restaurant
7:00 p.m.	Speakers' Banquet	D'Alessandro Villa

Awards

Outstanding Achievement and Promotion of the Chemical Sciences

Each year the Midland Section honors an individual residing within the Section's geographical area who has demonstrated outstanding achievement and promotion of the chemical sciences. This award recognizes dedication and service to the chemical profession.

Outstanding Service to the American Chemical Society

The Section sponsors an annual award to a member to recognize outstanding service to the Midland Section of the ACS. This award recognizes achievement in the promotion of the goals of ACS.

Outstanding Chemical Technician

The Section presents an annual Outstanding Chemical Technician Award to an individual who has demonstrated an extremely high degree of professionalism as a chemical technician.

Midland Section Scholarship

Each year the Section presents a college scholarship from an endowed fund inaugurated in 2003.

Members of ACS for 50 Years or More

70 Years

R.W. Von Korff

60 Years

Etcyl Blair	George Lewenz	Robert Fleming
James Rieke	Robert Huoni	

50 Years

Wendell Dilling	Robert Moolenaar	Jacob Eichhorn
Rudolf Salinger	James Hahn	

Keynote Speaker

Surface Modification of Organic and Inorganic Materials

Professor Manoj K. Chaudhury
Franklin J. Howes Jr. Distinguished Professor
Department of Chemical Engineering
Lehigh University

Surface modification of polymer and inorganic surfaces has a long history. The classical and modern methods of surface modification include plasma treatment, selective chemistry, self-assembly, and controlled deposition of polyelectrolyte to name a few. These surface modification methods in conjunction with the novel methods of surface patterning have led to the developments of new technologies in various materials science, biological, and medical fields.

In recent years there has been an explosion of interest in surface modification technologies. On one hand, scientists and engineers are looking for ways to miniaturize the technology to modify selectively the surfaces of colloidal and nanoparticles; on the other hand, they are exploring ways to modify surfaces that not only passively react to stimulus but also exhibit interesting and useful dynamic responses. For the latter applications, it is beneficial if the chemical interactions at surfaces can couple with their bulk mechanical properties. For example, it has been found recently that simple adsorption of molecules on the surfaces of slender objects can mechanically deform the latter with a dynamic response that can be used in the design of novel cantilever-based biosensors. Coupling of surface and bulk interactions is being investigated in controlling the flow of fluids in microfluidic channels and various MEMs devices as well. There is also a very new attempt to explore various types of instability phenomena for large-scale pattern formation with small feature sizes.

These self-organized systems are the result of co-operativity resulting from chemical, elastic, and hydrodynamic interactions. We will summarize some of the most important new developments in these surface modification technologies.

Education

- Ph.D. Chemical Engineering, State University of New York at Buffalo (1984).
- M.S. Biophysical Sciences, State University of New York at Buffalo (1980).
- B.Sc. Physics (Honors), Calcutta University (1976).

Experience

2001–Present:	Professor, Department of Chemical Engineering, Lehigh University.
1994–2000:	Associate Professor, Department of Chemical Engineering, Lehigh University (tenured: March 1997).
1996–2004:	Director of the Polymer Interfaces Center, an NSF sponsored Industry/University Cooperative Research Center, Lehigh University.
1991–1993:	Senior Research Specialist, Dow Corning Corporation. Promoted to Associate Scientist in 1993.
1987–1991:	Research Specialist, Dow Corning Corporation.
1984–1987:	Project Engineer, Dow Corning Corporation.

Please see the FSM link on the Section website for more background information on Prof. Chaudhury.

Photovoltaics Symposium

Chair: Ethan Good, Dow Corning Corporation

Development of Materials for the Manufacture of Unique Light Weight Flexible Thin Film Photovoltaic Products

G. DeMaggio, B. Yan, X. Xu, K. Lord, G. Pietka, F. Liu, K. Beernink, C. Worrel, A. Banerjee, J. Yang, and S. Guha
United Solar Ovonic LLC, Troy, MI

Light weight and ultra-light weight photovoltaic cells are filling unique roles in the area of electricity generation. This has enabled the development of new systems and access to new markets that can make use of this renewable energy source. To accomplish this, advances had to be made not only in the active, light absorbing device itself but also the machines used to fabricate these types of solar cells, encapsulation for protection against the elements, and methods to attach them to roofs and other structures. This talk will present a brief overview of the many developments that have occurred at United Solar over the last 20 years that made these devices possible.

Organic Materials on Nonplanar Substrates for Creating and Testing Photovoltaic Devices

K. H. An, Y. Zhao, B. O'Connor, M. Shtein, and K. P. Pipe
University of Michigan, Ann Arbor, MI

Organic materials have several advantages for electronic device design, including broadly tunable optoelectronic properties and freedom from lattice-matching requirements. Recently we have explored the fabrication of organic optoelectronic

devices on silicon-based AFM cantilevers, with the purpose of enabling new high-resolution microscopy techniques. These organic-based scanning probes allow, for example, radiative (optical) or nonradiative (Förster) coupling of energy to and from devices such as solar cells with nanoscale lateral resolution to probe electronic and optical transport behavior. Here we will discuss fabrication approaches, electrical/optical transport models, and scanning measurements for our organic-based scanning probes. We will show device designs aimed at minimizing the active probe area by means of focused ion beam milling, controlled thickness variations during vacuum deposition of organic materials on the nonplanar probe surface, or utilization of the electric field concentration at the probe tip. The various mechanisms by which energy can be transferred between the probe and a sample will be explored through simulations, highlighting mechanisms such as optical emission and surface plasmon polariton mediated transfer of exciton energy that are most relevant to photovoltaic devices. Finally, we will discuss further applications of organic materials on nonplanar substrates, including fiber-based photovoltaic cells.

Growing Pains of a Solar Material Explosion

Simon Yeung
The Dow Chemical Company, Midland, MI

Photovoltaic energy is one of the key and most promising renewable energy sources in the world. The photovoltaic market is approximately $30B in 2007, growing at an impressive 40% per year. The total market will approach $100B (2/3 for products, the rest in services) by 2010. Few market opportunities available today are characterized by such compelling attributes. However, various challenges surround PV materials. Efficiency and scale-up breakthroughs, reliability, materials usage to name a few. This talk will give an overview on selected key challenges and opportunities on current photovoltaic materials.

Quantum Dot Sensitized Solar Cells: Progress & Issues

Bradley D. Fahlman, Ph.D.
Department of Chemistry, Central Michigan University, Mt. Pleasant, MI

Though the estimates of remaining worldwide energy resources vary, many reports show that we cannot supply the current demand for oil, and the uranium resources will be fully exhausted within 70 years. However, long before fossil fu-

els are consumed, the effect of continuing to use them at current rates would cause further havoc to the climate through global warming. With the Earth's population currently at over 6.5 billion, and expected to surpass 9 billion by 2050, we must seriously look beyond non-renewable energy sources to sustain life on our planet. Among the many choices, photovoltaics remains the most intriguing. It is estimated that 89 PW of solar energy falls on the planet's surface each year. Though it is only possible to capture a fraction of this energy, a conversion of only 0.02% of this flux would be sufficient to meet our current energy needs. Herein, we will describe an emerging solar cell technology known as quantum dot sensitized solar cells (QDSSCs). A number of synthetic strategies for their design, as well as current/future limitations of this approach will also be discussed.

Chemical Sensors Symposium

Chair: Steve Keinath, Michigan Molecular Institute

Electrochemical Biosensor Using PorB Class II Porin from *Neisseria meningitidis* Embedded in a Tethered Bilayer Lipid Membrane

Sachin R. Jadhav[1], Yi Zheng[2], R. Michael Garavito[2], and R. Mark Worden[1]
[1]Department of Chemical Engineering and Materials Science, and [2]Department of Biochemistry and Molecular Biology, Michigan State University, East Lansing, MI

Cell membranes carry out many vital recognition, communication, transport, and catalytic functions at the molecular scale. Nanostructured biomimetic interfaces consisting of an artificial bilayer lipid membrane (BLM) with embedded membrane proteins mimic the structure of cell membranes and are able to reproduce many cell membrane functions in vitro. These interfaces offer a powerful platform for chemical sensor development. Ion channel proteins are particularly interesting for sensor development because they are used by cells as molecular sensors, and ion-channel activity can be readily measured electrochemically.

In this study, the porB class II porin from *Neisseria meningitidis* was incorporated into a BLM that was tethered to a gold electrode. Electrical impedance spectroscopy (EIS) and cyclic voltammetry were used to characterize porB-mediated ion transport through the resulting biomimetic interface. Impedance was found to

vary with applied voltage, suggesting that the porin's conductance is voltage-dependent. Planar bilayer experiments were performed to characterize the influence of applied voltage on porB conductance and to independently confirm the EIS results.

Biosensor interfaces based on tethered BLM and ion channel proteins are well suited for miniaturization and use in biosensor arrays. Research is underway to develop protein-based biosensor arrays for high-throughput applications, including drug screening, characterization of chemical toxicity, and functional characterization of novel membrane proteins.

One- and Two-photon Fluorescent Polyhedral Oligosilsesquioxane (POSS) Nanosensor Arrays for the Remote Detection of Analytes in Clouds, in Solution, and on Surfaces

Claire Hartmann-Thompson[1], Douglas L. Keeley[1], Kathleen M. Pollock[1], Petar R. Dvornic[1], Steven E. Keinath[1], Marcos Dantus[2], Tissa C. Gunaratne[2], and Dale J. LeCaptain[3]
[1]Michigan Molecular Institute, Midland, MI
[2]Department of Chemistry, Michigan State University, East Lansing, MI
[3]Department of Chemistry, Central Michigan University, Mount Pleasant, MI

A series of polyhedral oligosilsesquioxane (POSS) nanosensors functionalized with fluorophores that change their wavelength of emission in response to their chemical environment has been synthesized and characterized by IR, NMR, UV, one- and two-dimensional fluorescence spectroscopy, MALDI-TOF MS, and electrospray MS.

When each nanosensor in an array of *n* nanosensors is functionalized with a different wavelength shifting fluorophore, the array can generate a unique fingerprint comprised of *n* emission wavelength data points in response to a given chemical warfare agent (CWA) simulant or toxic industrial chemical (TIC). One-photon fluorescence fingerprints were constructed by measuring the fluorescence spectra of nanosensor-analyte pairs in solution. Two-photon fluorescence fingerprints were then generated by remotely interrogating nanosensor-analyte pairs using a femtosecond IR laser and a stand-off fluorimeter. Two-photon fingerprints were obtained for analytes in solution, on a surface, and in cloud form.

A four-component nanosensor array could differentiate a homologous series of alcohols, and it could also distinguish the G and VX classes of nerve agent simulants.

Chemical, Immunochemical, and Biochemical Sensors in the Diagnostic Industry

Paul S. Satoh
Neogen Corporation, 620 Lesher Place, Lansing, MI 48912

Various sensors are used in diagnostic products today, which include chemical and biosensors. They may use optical (absorbance, fluorescence, luminescence, Surface Plasmon Resonance) detectors, electrochemical detectors, or gas sensors depending on the target analytes. Some of the chemical and biological sensors used in analytical chemistry and diagnostics are reusable, while others are designed for one-time use. Beyond the scope of ELISA plate and tube-based discrete analyzers, most sensors depend on immobilized reagents on a solid surface (e.g., blood glucose analysis by glucose dehydrogenase (or oxidase) with an electrochemical detector as a one-time use, fast analysis.) Some sensors are incorporated into a multi-analyte assay such as a nucleotide/protein micro-array that allows the analysis of a vast number of determinants in one device.

Unlike ELISA, many immunoassays demand a rapid turnaround time for results from Lateral Flow Immunoassay (or Lateral Flow Receptor binding assay). In LF assays, a nano-particle labeled detector molecule (antibody or antigen) is allowed to flow through a chromatographic layer on which a capture molecule is printed to form a desired visible or fluorescent line that appears with the detector molecule. The throughput time for most LF assays is 10 to 15 minutes and they can be performed as sandwich or competitive assays (e.g., Surface Plasmon Resonance based immunoassay, in which the on-off kinetics are repeated until the capture antibody no longer binds to the ligand).

The following topics will be highlighted in the presentation: (1) the types of sensors used in diagnostics (clinical, veterinary, food safety, environmental); (2) the principles and performance criteria of biosensors; (3) examples of sensors used in food safety and their problems and solutions; (4) Neogen's biosensor approach; and (5) future perspectives.

Microfluidic Sensors for Flow and Chemical Concentration Measurements

Doug Sparks and Alec Chimbayo
Integrated Sensing Systems, Inc. (ISSYS), Ypsilanti, MI

The use of micro-machined sensor chips will be covered in this presentation. Integrated Sensing Systems has developed a family of sensors based on resonating microtubes that have been used to fabricate density, Coriolis mass flow, and chemical concentration meters.

Static measurements can be made with less than a microliter of a liquid sample, ideal for distillation and fermentation operations. Both liquids and gases can be measured with this technology. The fabrication and use of the MEMS chips will be discussed.

Nanostructured Surfaces Symposium

Chair: Mustafa Mohamed, Dow Corning Corporation

Synthesis and Characterization of Dendrimer-Encapsulated Nanoclusters: The Next Generation

Bradley D. Fahlman, Ph.D.
Department of Chemistry, Central Michigan University, Mt. Pleasant, MI

Of the many entraining agents that may be used to control the growth of 0-D nanoclusters, dendritic polymers are an ideal choice due to their structural precision and tunability. Thus far, the PAMAM dendrimer has been used most extensively for metal nanocluster growth. Herein we will describe our current efforts related to the growth of metal oxide and II-VI semiconductor nanoclusters entrained within a PAMAM dendrimer. The utility of these nanostructures toward applications in automotive paint and ink formulations, homeland security, quantum dot sensitized solar cells, and next-generation transistors will also be discussed.

Composition of Bi-Phasic Polymer Nanocolloids in Aqueous Suspension

Ginam Kim
Dow Corning Corporation, Analytical Science, Midland, MI

The molecular distribution and the interfacial width in nanocolloids of poly(dimethyl siloxane) (PDMS) and an organic copolymer [methyl acrylate (MA)-co-methyl methacrylate (MMA)-co-vinyl acetate (VAc)] preserved in a frozen aqueous solution were investigated using cryo-valence electron energy loss spectroscopy (VEELS) coupled with a scanning transmission electron microscope (STEM). The low energy-loss spectra, which depend on the valence electron structures of the PDMS, the copolymer, and the vitrified water, were substantially different. The spectrum datasets obtained were processed via multiple least squares (MLS) fitting to obtain quantitative phase maps of silicone and copolymer composition within individual nanoparticles. Quantitative line profiles from the resulting compositional maps indicate that the PDMS lobe of biphasic nanoparticles contained a significant amount of the copolymer and a diffuse interface was formed. Since the nanoparticle synthesis involves polymerization of acrylate monomer dissolved in PDMS nanoparticle precursors, these results suggest that the evolution of the nanocolloid morphology during synthesis is kinetically frozen as the acrylate copolymer achieves some critical molecular weight.

Probing Nanoscale Mechanical Properties of Heterostructured Polymeric Materials

Gregory Meyers, Valeriy Ginzburg, Hamed Lakrout, Bob McIntyre, Melinda Keefe, Ray Drumright, Kwanho Yang,
The Dow Chemical Company, Midland, MI

Sergei Magonov,† Natalia Erina, Lin Huang, Charles Meyer, Sergey Belikov, Chanmin Su, Craig Prater‡
Veeco Instruments, Inc., Santa Barbara, CA.

A better understanding of the relationship between nanoscale properties and bulk material performance is a critical need for material developers and formulators. In this work we describe a new AFM-based nanoindenting capability which is optimized for quantitative, nanoscale mechanical measurements (1). We apply this capability to measure properties of sub-micron sized polystyrene latexes with hollow cores. The ability to probe individual particles is important in explaining performance properties such as opacity in coating formulations. We use load-penetration data for different latex systems to characterize their elastic properties using appropriate contact mechanics models for the different loading regimes. We can probe the elastic response of the shell at low strain, the elastic-plastic response of the shell after yielding, and the gross buckling of the shell structure beyond plasticity. The data is further compared with FEA simulations from which additional parameters, such as yield stress, may be estimated. The combination of experiment and simulation is a powerful approach to understanding the deformation of a nanoscale hollow sphere. This work was supported by the NIST-ATP program (#70NANB4H3055).

†Current affiliation Agilent Technologies
‡Current affiliation Anasys Instruments, Inc.

1. Belikov, Sergey; Magonov, Sergei; Erina, Natalia; Huang, Lin; Su, Chanmin; Rice, Alan; Meyer, Charles; Prater, Craig; Ginzburg, Valeriy; Meyers, Gregory; McIntyre, Robert; Lakrout, Hamed, Journal of Physics: Conference Series (2007), 61, 1303-1307.

Nanoimprint Lithography and the Role of Polymer Viscoelasticity in the Generation of Residual Stresses in Nanoscale Patterned Surfaces

Christopher L. Soles
NIST Polymers Division, Gaithersburg, MD

Nanoimprint lithography (NIL) was originally perceived as a versatile, low-cost, and high-resolution patterning alternative for optical lithography in CMOS fabrication. However, it is becoming apparent that NIL has great potential for nanotechnology in general. It is capable of patterning sub-10 nm features directly into a range of materials, even functional materials, and not just sacrificial resist formulations. Intense R&D activities are currently centered on CMOS logic devices, bit patterned data storage media, high brightness LEDs, patterned biologi-

cal devices, and optical devices.

Our approach is to develop measurement platforms that quantify the quality of the pattern or feature that has been fabricated by NIL. These quantitative assessments of the imprint process are necessary inputs to optimize the NIL based R&D processes and move from the novel demonstrations or devices in the lab to the high volume nanomanufacturing required for commercialization. To accomplish this we leverage our internal expertise in accurately measuring physical shape and properties at the nanoscale. The way that the NIL process itself influences both the shape and properties of the imprinted materials has a profound impact on the performance, robustness and quality of the imprinted device. By providing the measurement component of the processing–properties–structure paradigm, we can accelerate the development of products based on the NIL technology.

In this presentation we focus on critical measurements relevant to the thermal embossing form of NIL. Here the resist or imprint material is heated to elevated temperatures and under the application of pressure, the viscous polymer melt flows into the cavities of the imprint mold. When the material is cooled back to room temperature and the mold is removed, the result is a free-standing replica of the imprint mold. Given the nanoscale dimensions of these cavities, the shear stresses generated during this flow can be significant, even inducing yield in the polymeric melt. This can lead to large levels of residual stress in the imprinted pattern. Our measurements show that these residual stresses can be controlled by understanding the rheology of the mold-filling process. At a given imprint temperature, there is a characteristic relaxation time for the polymer melt defined by the terminal time t_1 for viscoelastic flow. If the duration of the imprinting process is longer than t_1, then the shear-induced stresses have time to relax and the pattern is stress-free. If t_1 is longer than the imprint, then residual stresses are frozen into the pattern. Our analysis shows that these stresses can be minimized by reducing the molecular mass of the polymer, increasing the imprint temperature, or imprinting for longer times. These measurements are of direct relevance to roll-to-roll imprint processes where the mold is separated from imprint at elevated temperatures.

Poster Abstracts

#1

Synthesis of Hyperbranched Polymers for Use in a Prosthetic Heart Valve

Strong K., Harjer K., Mueller A.
Chemistry Department, Central Michigan University, Mt. Pleasant, MI

When patients undergo prosthetic heart valve replacement they must take blood anticoagulation medications that can have potentially dangerous side effects. Blood coagulation will occur on artificial surfaces when they are placed in the bloodstream which contains blood proteins and platelets, which causes a cascade effect of coagulation that can lead to a large blood clot on the artificial valve. A polymer coating that is able to stick and adhere to the surface of an artificial valve but can still retain anticoagulation properties can present a solution to the potentially harmful effects of blood anticoagulation medications. The polymer coating will be made of an outer coating that will have anticoagulation properties to prevent blood proteins and platelets and the inner coating will adhere to the surface of the heart valve made from pyrolytic carbon. The inner and the outer polymers have been synthesized and are both hyperbranched polymers. The many branches on the polymer will increase adhesion to the pyrolitic carbon on the surface of the heart valve, and the branches will also increase anticoagulation on the outer surface of the polymer coating. Resorcinol, hydroquinone, and catechol were the three monomers that were subjected to enzymatic polymerization by HRP. HRP is known to synthesize aromatic polymers via a radical mechanism. In our case oxygen is a part of the mechanism, instead of hydrogen peroxide, to regenerate the enzyme. Hydroquinone and catechol yielded linear polymers and resorcinol yielded a hyperbranched polymer. Trends during the synthesis of these polymers will be presented as well as some properties that can be used in other applications.

#2

Biocompatibility of Polysaccharides Gels for Use as Skin Scaffolds

Samantha K. Johnston[1], Anja Mueller[1], and Stephen J. Juris[1,2]
[1]Department of Chemistry and
[2]Department of Biology, Central Michigan University, Mount Pleasant, MI

Current graft treatments for severe skin damage have many problems associated with them, including slow healing time, function loss, and severe scarring; prompting researchers to consider other materials as alternatives for treatment. Alternative materials, such as skin grafts, may allow for faster healing with reduced scarring, but may have problems of biocompatibility and material strength. Polysaccharide materials, composed of complex carbohydrates, are materials that could potentially solve many of the permanent side effects associated with current skin graft treatments. This research tested the biocompatibility of polysaccharide gels, which are prepared and whose properties are tested in an independent study, in order to determine the potential for utilizing such materials as skin scaffolds for burn victims.

We found that individual components of the gels had different

biocompatibility properties with human fibroblast skin cells. Xantham, κ-carrageenan, ι-carragennan, calcium lactate, and sodium benzoate were biocompatible, while *N*-methyl pyrrolidone, Cosmocil CQ, malic acid, and potassium chloride were completely toxic to the cells. Toxic components were further tested to determine the dose dependency of those compounds' toxicity to human fibroblasts. Finally, we tested the toxicity of a polysaccharide gel on human fibroblasts. These biocompatibility data will be critical in preparing polysaccharide gels that will be predicted to be non-toxic to human skin cells.

#3

Synthesis of a Water Soluble Highly Fluorinated Hyperbranched Polycarbosiloxane and Preliminary Investigation of its use as an Oxygen Therapeutic ("Blood Substitute")

Steven N. Kaganove,[1,2] Rakesh Sachdeva,[1] Abhijit Sarkar,[1] Benedict R. Lucchesi,[3] and Susan A. Stern[4]

[1]Michigan Molecular Institute, Midland, MI

[2]Dendritech, Inc., Midland, MI

[3]Department of Pharmacology, U of M Medical School, Ann Arbor, MI

[4]Department of Emergency Medicine, U of M Medical School, Ann Arbor, MI

In the future, adequate supplies of untainted donated blood for treatment of trauma victims and other high priority medical needs may not be available at all times. To address this need, a number of companies and academic research groups are developing synthetic oxygen therapeutics (blood substitutes), which replicate the most essential oxygen and carbon dioxide transporting functions of blood. In contrast to donated blood, the substitutes have little to no risk of transmitting disease, and there is also no need for typing. Two main approaches have been used to date, including crosslinked hemoglobin and fluorocarbon emulsions. Although most of the commercial efforts have focused on crosslinked hemoglobin, this approach has been plagued by statistically significant higher death rates than control experiments in some ambulatory care clinical trials. In light of these difficulties, the fluorocarbon approach merits renewed study. A drawback to both approaches is the need for refrigerated storage for extended shelf life and stability. Synthesis of a soluble, stable macromolecule is described here as a strategy to circumvent the inherent long term instability of fluorocarbon emulsions. The target polymer is a highly fluorinated hyperbranched polycarbosiloxane, chemically modified to attain high water solubility. The results of preliminary uncontrolled hemorrhagic shock model experiments in rabbits are also described.

#4

Dendrimer-based Nanomaterials: Preparation and Characterization

Zhiyuan Wang, Keith A. Freel, Lindsay Cronin, Che Hin Ho, Michael Kruskamp, Dian He, Aaron K. Holly, Casey Manning, Peijie Ong and Minghui Chai

Department of Chemistry, Central Michigan University, Mt. Pleasant, MI 48859

In this study, various nanomaterials including metal complexes, host-guest and self-assembled systems were prepared via utilizing the surface multiple function-

ality and the inner void space of dendrimers. NMR spectroscopy has been utilized to characterize the structures and investigate the properties of these nanomaterials. Atomic force microscopy (AFM) has also been used to probe the dendrimer-based nanostructures. The information on the structures, sizes, and interactions of these systems can be obtained through unambiguous nuclear correlations in multidimensional NMR spectra, and relative nuclear motions from relaxation and diffusion NMR measurements, as well as vivid AFM topographic images and force distance curves.

#5

Fuel Cell Membranes: Synthesis, Analysis and Characterization

Samik Upadhaya and Anja Mueller
Central Michigan University, Department of Chemistry, Mt. Pleasant, MI

Hydrogen Fuel Cells (HFC) are viewed today as an ideal source of alternative energy because they can produce 'clean' and sustainable energy without fossil fuels, combustion, and environmentally hazardous emissions. The operational efficiency and effectiveness of HFC are greatly enhanced by the right kind of fuel cell membrane (also known as Proton Exchange Membrane (PEM)) material. The research is working towards making an effective membrane. The major focus of this project has been on the synthesis, analysis, and characterization of PEM. The process involves the synthesis of a monomer and its characterization, which in turn has been used to create a hyperbranched perfluorinated polymer that has been purified and characterized. The thermal and chemical stability of the polymer is being characterized, as well as its water conductivity and proton conductivity.

#6

Development of Polymer-Based High Oxygen and Low Moisture Permeable Chemically Resistant Membrane

Salma Rahman, Steve Kaganove, Petar Dvornic, Dale Meier, and Abhijit Sarkar.
Michigan Molecular Institute, 1910 West St. Andrews Rd., Midland, MI

High oxygen and low moisture permeable chemically resistant membrane was fabricated utilizing hyperbranched polymers. The barrier properties of the membranes (e.g., permeability of oxygen, water, and organic solvent vapors) were evaluated. Very high oxygen permeability (~10^4 Barrer) and very low moisture (~15 Barrer) and organic solvent vapors permeability (~1 Barrer) were achieved. The membranes also showed excellent chemical resistant properties (i.e., no weight loss or swelling upon exposure to chemicals). These membranes should be useful for applications where high oxygen concentration or pure oxygen is desired. These membranes are also useful to provide environment free of moisture and/or chemical vapor.

#7

Evaluation of Multiwalled Carbon Nanotubes-Hyperbranched Polymer Nanocomposites for Photonic Applications

Shamim M. Mirza, Salma Rahman, Petar R. Dvornic, Abhijit Sarkar
Michigan Molecular Institute, 1910 West St. Andrews Rd., Midland, MI

We have investigated optical and nonlinear optical properties of multiwalled carbon nanotubes (MWNTs)-hyperbranched polymer (HBP) nanocomposites for their potential in photonic applications. Nanotubes have been dispersed in HBP without the use of any solvent and the resulting suspension remained stable in the polymer matrix as long as the polymer did not undergo cross linking reaction itself. Optical transmittance of the film was inversely proportional to the concentration of nanotubes and could be controlled within a 0% to 90% range over the whole visible region of the spectrum (400 to 800 nm). The MWNTs-HBPs composites showed excellent nonlinear scattering effects and when combined with other active photonic components, they can be used in various photonic applications.

#8

Green Flame Retardants: Modification of Diethyl Tartrate

Katelyn Cater and Bob A. Howell
Center for Applications in Polymer Science, Central Michigan University
Mt. Pleasant, MI

Tartaric acid is a by-product of the wine industry (Michigan is the sixth largest wine-producing state in the nation) and, therefore, eminently renewable. It is also available at modest cost. It is being used as the base for a family of "green" phosphorus flame retardants. The hydroxyl groups may be protected with a variety of groups, preferably phospohorus moieties, to provide a diester suitable for the generation of oligomers or polymers. Condensation of the diester with diols of varied structure is possible. If the diol also contains phosphorus, oligomers containing a high level of phorphorus may be generated.

#9

Vapor Sensing of Chemical Agents via Functionalized PAMAM Dendrimer Coatings

Claire Hartmann-Thompson, Douglas L. Keeley, S. E. Keinath and P. R. Dvornic
Michigan Molecular Institute, Midland, MI

A number of fluorophore-functionalized PAMAM dendrimers were prepared at various generations and substitution levels, and a number of these were reacted further with 3-acryloxypropyldimethoxymethylsilane to make curable coating compositions. In the first step, commercially available fluorophores, dansyl chlorides with side group orientations (1,5-, 2,5- and 2,6-), were reacted with amino-terminated PAMAM dendrimers of various generations. The materials were characterized by thin layer chromatography, MALDI-TOF mass spectrometry and fluorescence spectroscopy. Coatings were cast onto glass microscope slides from

20 wt.% methanol solutions of Gn PAMAM(fluorophore)$_x$(DMOMS)$_y$ and cured in air at 80°C for 2 hours (although cure at room temperature over several days was also possible). In a series of experiments, the cured fluorophore-functionalized PAMAM dendrimer coated coupons were then dipped into various liquid analytes, and the fluorescence spectrum of the 'wet' coupon was measured immediately after dipping. The coupons could distinguish between a range of organic solvents and toxic industrial chemicals.

#10

Interactions between Lithium and Graphene Nanoribbons

Chananate Uthaisar, Veronica Barone and Juan Peralta
Department of Physics, Central Michigan University, Mount Pleasant, MI

Graphene nanoribbons, which are quasi-one dimensional strips of graphene, are currently attracting a lot of attention due to their peculiar properties. Understanding the interaction of lithium and graphene nanoribbons is crucial for the design of denser Li-ion batteries and more efficient hydrogen storage materials. In this work, we present density functional theory results for the interaction between Li atoms and graphene nanoribbons. We compare the binding energies of Li atoms on the most stable hollow sites in armchair and zigzag nanoribbons with the corresponding values in two-dimensional graphene. Our results show a much stronger interaction between Li atoms and zigzag nanoribbons in comparison with either graphene or armchair nanoribbons. We rationalize this enhancement by considering the magnetic nature of this particular morphology.

#11

Catalysts Tethered to Carbon Nanotubes

Adina Dumitrascu and Bob A. Howell
Center for Applications in Polymer Science, Central Michigan University
Mt. Pleasant, MI

Carbon nanotubes are interesting carbon structures that offer potential for application in a wide variety of areas. The increasing availability and decreasing cost of these materials make them attractive as platforms to support a variety of catalytic agents. Carbon nanotubes can be oxidatively functionalized to provide either carboxyl or hydroxyl groups at the surface. These groups provide points of attachment for tethers to good metal coordinating lignands. For example, 1,10-phenathroline may be converted to the 5,6-epoxide and this opened to provide the 5-hydroxy compound. Conversion of the phenol to the corresponding phenoxide followed by treatment with ethylene oxide generates a tether with a primary hydroxyl terminus which may be used to anchor the ligand to functionalized nanotubes *via* either ester or ether linkages.

#12

Synthesis of a Constrained Sequestering Agent

Rebekah Collins-Cronkright, Brandon Brandt and David Baker
Science Division, Delta College, University Center, MI

Sequestering agents can be found in many biologically active molecules. Many chelators are active site mimics that can be used as catalysts, chemzymes or phase transfer catalyst. The methods and synthetic strategies used to prepare this constrained cyclohexyl oxygen-rich chelating agent are based on simple sophomore organic chemistry reactions. Its unique structure and conformational requirements make it an interesting candidate for supramolecular research.

#13

Imprinted Polymers for the Removal of Hydrophilic Metal Complexes from Water

Syed Ashraf, Angela Cluley, Anja Mueller Ph.D.
Department of Chemistry, Central Michigan University, Mt. Pleasant, MI

In wastewater treatment, the removal of heavy metals is difficult but important due to the health effects of these toxic compounds. Imprinting polymerization is a method to prepare polymers with specific molecular recognition properties for a given compound, its structural analogues, or for a single enantiomer. The molecular imprinted polymers show high selectivity and affinity to the predetermined molecules (templates) and are used for the efficient separation of specific compounds. In this research project imprinting polymerization is used to develop resins with high capacity and selectivity for heavy metal ions for water treatment. A random copolymer of methacrylate and methacrylamide was found to be most effective for the removal of hydrophilic metal complexes, like CsCl, $CdCl_2$ and NaH_2AsO_4, particularly when the porosity of these resins is increased. Copolymer is imprinted with heavy metal ions to increase the capacity of the flocculants for toxins. The structure and the thermal properties of all resins are carefully characterized with IR, TGA and DSC. Complete removal for up to 80 ppm of cadmium with only 50 mg of imprinted resin was obtained. As retention is highly dependent on surface area, porosity and swelling of these resins in water are also discussed.

#14

Waste Water Remediation

Veronica Frawley, Syed Ali Ashraf, Anja Mueller
Department of Chemistry, Central Michigan University, Mt. Pleasant, MI

This project consists of the characterization of synthesized polymer resins to be used in waste water remediation. The synthesized resins; synthesized by Dendritic Nanotechnologies Inc., will be characterized using a variety of tests, such as the moisture holding capacity test, and perchlorate capacity tests, as well as competing ions. With these tests, the resin will be optimized for perchlorate removal. Perchlorate is a particularly dangerous ion to ingest as it can cause neurological,

cardiovascular, and prenatal damage. Thus, optimizing a resin to remove this harmful ion will increase the safety of public drinking water.

#15

A Diffusion NMR Study on PPI-3 Dendrimer-Based Inverse Micelle

Barbara Pavan, Keith Freel, Minghui Chai
Department of Chemistry, Central Michigan University, Mt. Pleasant, MI

The work used diffusion NMR spectroscopy to investigate the self-assembly process of inverse micelles, made of the 3rd generation poly(propylene imine) (PPI-3) dendrimer and hexanoic acid. The diffusion coefficients of the dendrimer and acid moieties were respectively measured in the deuterated methanol solution, which is the only solvent capable of dissolving the inverse micelle system effectively. A series of inverse micelle samples were prepared using gradually increasing amounts of fatty acids in the solutions with the same amount of PPI-3. The results from this study clearly demonstrate the self-assembly between the dendrimer and the fatty acids by showing more resolved dendrimer resonances in the inverse micelle system's ^{1}H-MNR spectra. Moreover the diffusion coefficients of the inverse micelles at various ratios showed a trend: the diffusion coefficients measured from NMR study are reduced with increasing amount of fatty acids in the self-assembly prior to the stoichiometric ratio 1:16. The smallest diffusion coefficient was observed experimentally at the 1:14 ratio of PPI-3/Hexanoic acid system. Right after this, the diffusion coefficient increases. This indicates that beyond 1:14 ratio, the excess fatty acids exist in the inverse micelle system. These "free" acids do not associate with the dendrimer anymore, thus diffuse fast. In diffusion NMR, an average diffusion coefficient of "self-assembled" and "free" fatty acids is measured. Further studies will be performed on the inverse micelle systems involving different generation PPI dendrimers as well as different type of fatty acids.

#16

Characterization of Amphiphilic PAMAM Dendrimers Using Diffusion NMR

Hien Do, Zhiyuan Wang, Nicole E. Chamberlain, Minghui Chai
Department of Chemistry, Central Michigan University, Mt. Pleasant, MI
Tracy Zhang, and Steven N. Kaganove
Michigan Molecular Institute, Midland, MI

In this work, the diffusion coefficients of 0-6 generation PAMAM dendrimers with opened epoxide group and ester group connecting to hydrophobic C12 tails were measured in deuterated chloroform solution using diffusion NMR spectroscopy. Hydrodynamic radii (R_H) of these dendrimers were then calculated based on the Stokes-Einstein equation using the obtained diffusion coefficients, the experimental temperature (held constant at 25°C), and solvent viscosities. The results from this study clearly demonstrate that the hydrodynamic radii of these dendrimers are increased with the generation of the PAMAM dendrimers. For the 6th generation PAMAM dendrimer, the hydrophobic tails seemed more extended than those in 4th and 5th dendrimers, leading to a tight packing on the surface of the 6th generation dendrimer because of the steric hindrance.

#17

Interactions of Dendrimers with Herbal Drugs: Computer Simulations and Analysis

Pratik Chhetri and Leela Rakesh*
Department of Mathematics, Central Michigan University, Mt. Pleasant, MI

Dendrimers have been reported to act as solubilizing agents to host both hydrophilic and hydrophobic drugs. The application of dendrimer–drug complexation in the enhancement of drug solubility and bioavailability and the use of the complexes as vehicles for the controlled release of drugs and drug targeting is being investigated. Of particular interests are PAMAM (Poly Amido Amine) and lacto-(carbohydrate-coated) dendrimers, which are uniform, highly branched structures, thus can encapsulate and hold drugs. Towards this endeavor, a preliminary study is being conducted using computer simulation, in order to understand the interaction between drugs(herbal components derived from easily accessible herbs and spices) and various generations (1 -8) of dendrimers with/without linkers (succinyl, diethylene glycol) and in the presence of linear chain polymers such as polyethylene glycol with particular reference to the entrapment of drugs within the dendrimer architecture to form the electrostatic and covalent complexation of drugs to the dendrimer surface. The purpose of the present study is to evaluate the potential of dendrimer-drug conjugates to enhance the bioavailability of a drug, which can be a leap in Drug Delivery Systems (DDS) as a whole.

#18

Rheological Study of Polypropylene with Short COOH and OH Functionalized Multi-walled Carbon Nanotubes

Michael Lalko[1], Leela Rakesh[2], Stan Hirschi[3]
[1]Department of Engineering and Technology, [2]Department of Mathematics,
[3]Department of Physics, Central Michigan University, Mt. Pleasant, MI

The addition of nano-sized particles into a polymer matrix is an excellent way to manipulate polymer properties. Our current efforts try to understand how materials properties are influenced by parameters such as temperature, particle size, particle concentration, and composition. Polypropylene nanocomposites, containing 0.5 % wt. short multi-walled carbon nanotubes (MWNTs), were prepared by extrusion and injection molding. The effects of functionalized MWNTs on the nanocomposites systems were studied with rheology. The properties examined through rheological experimentation include: viscosity, critical strain, storage modulus and loss modulus. The nanocomposite samples were examined using scanning electron microscopy (SEM) and an optical microscope.

#19

NMR Study on the Solvolysis of cis-1,2-Dichloro(trans-1,2-diaminocyclohexane)platinum(II) Complex in DMSO

Ewa Gorski, Gary Wilks, and Minghui Chai
Department of Chemistry, Central Michigan University, Mt. Pleasant, MI

Cisplatin has been a revolutionary drug for cancer treatment, yet its toxicity to patients results in problems. Recent studies showed that salicylate can reduce cisplatin toxicity on hearing and kidney function without compromising its oncolytic action. Therefore, using salicylic acid in cisplatin chemotherapy can potentially provide a safe and effective treatment for cancer patients. This poster presents the initial work in producing the platinum (II) ion complexes as cisplatin analogs. NMR studies were done and have shown the success in the synthesis of the anticipated compound. However, it was found that the compound gradually changed in DMSO solution during the NMR measurements. Detailed analyses and kinetic studies were done to understand the change of the compound in DMSO, which is the only good solvent for the Pt (II) complex.

#20

Probing Self-assembly of Dicarboxylic Acids on PPI-3 Dendrimer in Water via Diffusion NMR Spectroscopy

CheHin Ho, Lindsay Cronin, Peijie Ong, Minghui Chai
Department of Chemistry, Central Michigan University, Mt. Pleasant MI

Poly(propylene imine) (PPI) dendrimers are core-shell nanostructures with well-defined architecture and low polydispersity. They are synthesized in a cascade fashion around a core unit, emanating with high level of control over size, and they also have multiple branching points and surface functionality. The tailoring dendrimer properties also make them ideal carriers for drug delivery. Self assembly refers to the organization of a disordered system without external direction. The diacids can assemble onto the surface of amine-terminated PPI dendrimers via proton exchange from the carboxyl groups of the diacids to the amine groups of the dendrimer. Thus through the electrostatic interaction, the diacids are tightly associated on the periphery of the dendrimers. As a result, the motion of both the diacid and dendrimer are more restricted, which will cause a reduction in the diffusion coefficient. In this work, the diffusion coefficients of the third generation PPI dendrimers with different dicarboxylic acids were measured in deuterated water using diffusion NMR spectroscopy. The diffusion coefficients of the diacids and dendrimers were then calculated based on the signal intensities from the NMR measurements. The results from this study clearly demonstrate that the most efficient self assembly with PPI3 was formed by the succinic acid, which is an aliphatic acid and has the least number of carbons among all the acids used.

#21

Methods for the Generation of Platinum(IV) Antitumor Agents

Adina Dumitrascu, Pratik Chhetri and Bob A. Howell
Center for Applications in Polymer Science, Central Michigan University
Mt. Pleasant, MI

Organoplatinum antitumor agents (Cisplatin, Carboplatin) are among the most effective and widely used cancer drugs. These compounds are broad spectrum drugs based on platinum(II). Recently, there has been interest in platinum(IV) compounds with antitumor properties. Two methods for the generation of such compounds are being explored. The first involves the oxidation of Cisplatin with nitric oxide to generate reactive species which can be treated with various ligands to generate stable platinum(IV) compounds. To date, this approach has not been found to be reproducible or to afford a single major product. In a second approach hydrogen peroxide is used as the oxidant to generate a (dihydroxo)platinum(IV) compound which can be modified.

#22

Synthesis and Surface Grafting of PAMAM Dendrimers with Biocidal N-Halamine End-Groups

Steven N. Kaganove,[1,2] Tracy Zhang,[1] Keri Niec,[3] and Stephen Cendrowski[3]
[1]Michigan Molecular Institute, Midland, MI
[2]Dendritech, Inc., Midland, MI
[3]Biomedical Laboratory Diagnostics Program, MSU, East Lansing, MI

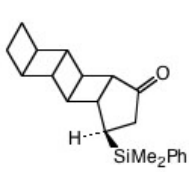
N-Halamines are inorganic and organic compounds in which oxidative halogens are attached to nitrogen. In aqueous solution, chloramines and bromamines undergo hydrolysis in varying degrees to form HOCl and HOBr. In cyclic chloramines the rate of hydrolysis is relatively slow and controllable, and as a consequence, they are particularly useful as environmentally friendly biocides. Incorporation of N-halamine functional groups in polymers conveys additional benefits typical of these solid state materials, including processability, good surface coating properties, and insolubility in water or organic solvents (when grafted to surfaces or crosslinked). Since halogen release presumably takes place mainly at the polymer surface, it should be advantageous to maximize the availability and surface density of the biocidal N-halamine groups. Towards this end, the end-groups of a G4 polyamidoamine (PAMAM) dendrimer have been modified to completion with 5,5-dimethylhydantoin, and the obtained product confirmed by ^{1}H and ^{13}C NMR spectroscopy. Incomplete conversion of the end-groups yields a PAMAM with additional functionality that can be crosslinked or grafted to a surface. The latter has also been successfully fabricated as the top layer to PAH/PSS and PAH/PAA polyelectrolyte multilayers.

#23

Review of Recent Applications of Photocycloaddition Reactions of Nonracemic Compounds

Wendell L. Dilling
Department of Chemistry, Central Michigan University, Mt. Pleasant, MI

This poster reviews several recent publications where photocycloaddition reactions served as key steps in the syntheses of nonracemic compounds. One of the olefinic reaction partners in each case was an a,b-unsaturated carbonyl compound. Five types of intermediates, **1-5**, were prepared by these reactions in the syntheses of pentacycloanammoxic acid, cyclobutane-fused nucleosides, precursors to the *Melodinus* ring system, 2-aminocyclobutanecarboxylic acids, and sceptrin, respectively.



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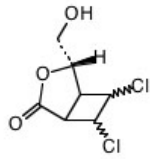

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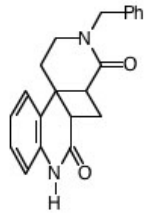

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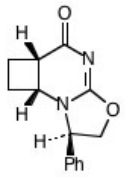

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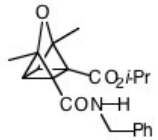

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#24

Synthesis of 1,1,2,2-Tetra(3,5-dibromophenyl)-1,2-ethanediol as a Precurser to Highly Halogenated Strained Five-Membered Heterocycles

Young-Jun Cho and Bob A. Howell
Center for Applications in Polymer Science, Central Michigan University
Mt. Pleasant, MI

Heavily-substituted five-membered cyclic compounds containing three hetroatoms have a strained carbon-carbon bond which undergoes homolytic thermolysis at modest temperatures to generate a diradical capable of initiating vinyl polymerization. If the substituents are bromoaromatic groups this provides a ready means of introducing a flame-retarding moiety directly into the polymer mainchain. A diol precursor to such strained hetrocycles has been prepared in several steps starting from 1,3,5-tribromobenzene.

#25

Design Synthesis and Evaluation of Group-1 Specific Neuraminidase Inhibitors

Joye B. Kallgren, Christopher E Duymich and Jeffrey A. Turk
Department of Chemistry, Alma College, Alma, MI

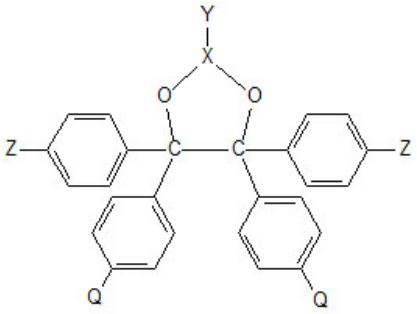
Neuraminidase cleaves terminal sialic acid units from carbohydrates on the surface of influenza-infected cells, facilitating propagation of the virus. Osteltamivir and Zanamivir are both current FDA-approved therapies for human influenza, which inhibit sialic acid cleavage by competitively binding to the active site of neuraminidase. These drugs were designed based on crystal structures of group-2 neuraminidases because crystal structures of group-1 neuraminidase were not available. Because of the sequence homology of group-2 to group-1 neuraminidase, it was expected that their active sites would be structurally identical. However, recent x-ray crystallographic structures of N1 (a group-1 neuraminidase) show that the active site is larger than once thought. We propose a series of group-1 neuraminidase specific inhibitors may bind more strongly than Osteltamivir based on Autodock 4.0 calculations. Since a group-1 neuraminidase is utilized for propagation of the highly pathogenic avian influenza (H5N1), these proposed inhibitors may provide information that leads to improved drugs for infections of H5N1 in humans.

#26

Routes to Novel Flame Retardants: Synthesis of 4,5-Di(4-bromophenyl)-4,5-di[4-diphenylphosphato)phenyl]-2,2-diphenyl-1,3-dioxa-2-silole

ZengRui Feng and Bob A. Howell
Center for Applications in Polymer Science, Central Michigan University
Mt. Pleasant, MI

A way to impart flame retardancy to a polymeric material is to use a strained, five-membered hetrocyclic compound of the kind shown below as an initiator for vinyl polymerization. Several such compounds have been considered for this application. Some lack sufficient stability to permit ready preparation even at low temperatures. Others undergo change over time to generate the corresponding epoxide and other compounds. A stable compound of this kind where Z is bromine, Q is diphenylphosphate and X is silicon may be prepared in several steps starting with inexpensive 4-bromophenol.

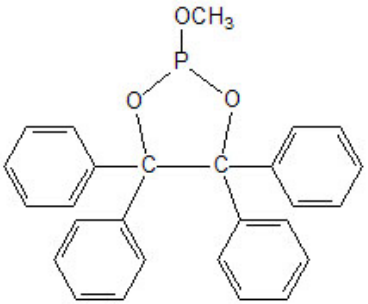


#27

Stability of 2-Methoxy-4,4,5,5-tetraphenyl-1,3,2-dioxaphospholane

Young-Jun Cho and Bob A. Howell
Center for Applications in Polymer Science, Central Michigan University
Mt. Pleasant, MI

As part of a broad effort to generate and utilize strained hetrocyclic compounds as initiators for radical polymerization a number of dioxaphospholanes have been examined. One of these can be prepared by treatment of 1,1,2,2-ethanediol with phosphorus trichloride followed by quenching with methanol. The compound (below) can be generated at -20 ºC but as the temperature is allowed to rise decomposition occurs to generate predominately 2,2,3,3-tetraphenyloxirane, some tetraphenylethylene, and perhaps benzophenone. These transformations can be readily followed by monitoring the change in the carbon-13 NMR spectrum of the mixture.



#28

Sandalwoods via the Allene-Claisen Rearrangement

Blake Reed and Jeffrey Turk*
Department of Chemistry, Alma College
Alma, MI

Natural sandalwood oil costs between $1000 and $1500 per kilogram. As the cost of sandalwood oil continues to increase, companies that produce fragrance ingredients as well as academic institutions seek to create synthetic alternatives. One difficulty with making receptor-specific fragrance ingredients is their interactions with olfactory receptors are mostly unknown. An alternative method for designing fragrance ingredients is to mimic the structure of known odorants (similar to ligand-based drug design). Our goal is to exploit the highly atom efficient Allene-Claisen rearrangement to produce new sandalwood odorants. An important feature that sandalwoods have in common is that they contain a bulky core, a carbon chain terminating in an alcohol, and typically have b-branching from the alcohol. We are currently using the Allene-Claisen rearrangement to produce sandalwoods to be sent to our collaborators at Givaudan (Switzerland) for odor analysis. These molecules will have a methyl or methylene group at the b-position. In addition, we are developing a new Allene-Claisen rearrangement that

will result in placing a saturated or unsaturated ethyl group at the b-position. Progress towards both projects will be shown.

#29
Pelletized Hot-Melt Adhesive Compositions
Frank Krabbenborg and Martine Rousse
Automotive TS&D, The Dow Chemical Company, Midland, MI

This poster relates to pelletized hot melt adhesive compositions, and in particular to compositions of the type able to form an initial bond between steel parts to be bonded such that the parts can be handled after the initial bonding process, and which subsequently form a permanent bond by a reactive heat curing process. Such adhesives are generally known as reactive hot melt adhesives (RHMAs). In the automotive industry, Epoxy adhesives are used for example as Crash Durable Adhesives (CDA) and Crash Durable Reinforcement (CDR) for use in an automotive body shop. Currently, these functions are usually fulfilled by compositions with paste-like or liquid consistency, with a range of viscosity depending on the application. However, these liquid adhesives have a number of problems or difficulties associated with them. When used to adhere steel and or aluminum, liquid and low viscous adhesives have a tendency to "bleed through" other areas, which can destroy the visible decorative surface. The "bleed through" problem associated with liquid adhesives can be solved to some extent using thickeners. Often, due to its high viscosity, the paste needs to be heated to allow efficient application, narrowing the utilization window of the formulated paste. This technology is supported by the business and seen as next step in adhesive technology for curable epoxy adhesives when the application of the granular adhesive can be done without any issues.

#30
Surface Analysis of Foil Detectors from High-Velocity Impacts of Meteorite Fragments
Anderson Minnick and Melissa Strait
Alma College Chemistry Department, Alma College, Alma, MI

Using meteorites as analogs in high velocity impact tests, we can gain a better understanding of how asteroids fragment upon impact in space. In analyzing foil detectors from high velocity impact experiments at Ames Vertical Gun Range, it was found that not all of the particles passed through the detectors; particles that were too small or slow instead created pits in the foil. The analysis was done by scanning light through the holes in the foil. This method ignored the pits. In this work, we scanned the foils into the computer and, using an image-processing program as well as the direct settings of the scanner, we attempted to manipulate the images to identify and analyze the pits. This proved unsuccessful due to interference from the rough surface of the foil. The foil surface also posed a problem when we attempted to use a reflecting light microscope with a digital camera mount. The resolution was too high and the pits were lost when the reflected light accented the rough surface of the foil. We also learned that the holes in the foil

interfere in identifying the pits in the foil when scanning and taking pictures. We are still searching for a method to analyze the surface pits while reducing the interference of the holes and the foil itself.

#31

Thermal Characterization of High Temperature Hydraulic Fluid

Stephanie Meyer and Bob A. Howell
Center for Applications in Polymer Science, Central Michigan University
Mt. Pleasant, MI

The functioning of much equipment, large and small, is dependant on the availability of stable, non-reactive, non-flammable hydraulic fluid. The thermal properties of three commercially available hydraulic fluids are being examined by thermogravimetry, pyrolysis/gas chromatography, and preparative pyrolysis. Characterization of major pyrolysis products is being accomplished spectroscopically.

#32

Application of Ultrasonics and Field Flow Fractionation to Biodiesel Production in a Continuous Laboratory Process

Michael Todd, Bill Kelley, David Allan, and Dale LeCaptain
Department of Chemistry, Central Michigan University, Mt. Pleasant, MI

Biodiesel is a renewable energy source that is produced from plant oils. Biodiesel is chemically produced by taking plant oils and transforming them into alkyl monoesters. This can be done in a batch or continuous process. A batch process requires multiples steps and transferring of products while a continuous system does all the processing in multiple stages without requiring transferring of products. The continuous reactor discussed here is capable of handling the 3,500 gallons/year of oil being used on campus. Using techniques such as sonication for the mixing of the starting materials, field flow fractionation (FFF) for initial glycerol separation, and cation exchange resins for the final removal of any glycerol and water, we are able to get good product yield in a relatively short amount of time.

#33

Technician Affiliate Groups "TAGs"

Debbie Bailey, Dow Corning Corporation, Midland, MI
Craig Dunn and Mary K. Moore, Research Laboratories, Eastman Chemical Company, Kingsport, TN

A technician's work can be more satisfying if it is seen as a worthwhile career rather than just a job. The Technician Affiliate Group (TAG) seeks to develop and strengthen a positive career attitude, which can benefit the technician and their employer. The Choice is yours! The concept to develop a professional organization for technicians was originated by concerned members of the ACS. These members saw a need to recognize the Technician as an important member of the scientific team and to assist him/her in acquiring supplemental educations in his/her line of work. This poster covers activities of the TAGs and where they are located.

#34

Candidates for ACS President and National Directors from the Midland Section – Part 2

Wendell L. Dilling
Department of Chemistry, Central Michigan University, Mt. Pleasant, MI

A poster with the same title as this one minus the Part 2 was presented at the 1981 Midland Section ACS Fall Scientific Meeting. That occasion was just prior to the election where David C. Young was an unsuccessful candidate for ACS President-Elect. In 2007, 26 years later, Thomas H. Lane was elected as 2008 ACS President-Elect. This poster reviews those Midland Section members who have served (or will serve) as ACS president, Edgar C. Britton (1952), Thomas H. Lane (2009), or a member of the national ACS board of directors, Willard H. Dow (1937–1948), Edgar C. Britton (1949–1951), David C. Young (1984–1989), or were unsuccessful candidates (or proposed nominees) for these positions, Edgar C. Britton (President-Elect 1948, 1949) Ray H. Boundy (Director 1955, 1956), Howard S. Nutting (President-Elect 1962), David C. Young (Director 1975, 1976, 1977, 1980, 1989, President-Elect 1981), Thomas H. Lane (Director 2004).

#35

Mid-Michigan Technician Group in 2007

Gerard Nowaczyk,[1] Dana Fuerst,[2] Deb Mendrick,[2] Wendy Klein,[2] and Debbie Bailey[1]
[1] Dow Corning Corporation, Midland, MI 48686-0994
[2] The Dow Chemical Company, Midland, MI

The Mid-Michigan Technician Group (MMTG) strives to provide Chemical Technicians with opportunities to develop and expand their professional skills. MMTG had a very successful year in 2007. Membership levels rose to an all time high (up 29% by year end) and the number of members that ran for an elected position also increased. MMTG held two lunchtime seminars. The first seminar was an audio seminar titled “How to Handle Difficult People”. The second seminar featured MMTG’s Elected Director, Grant Thomas, Partnered Staffing Manager of Kelly Scientific Resources, as he spoke about “Employment Trends for Chemical Technicians”. MMTG was also very active in public outreach programs, with members participating in National Chemistry Week, Sci-Fest 2007, Fall Scientific Day, and many chemistry demonstrations at local fairs and schools. Three members also participated in the Career Pathways held at Delta College, where hundreds of local high school students were allowed to find more information on their careers of interest. Members also participated in the Salvation Army’s Adopt-A-Family program and since the father of the adopted family was deployed to Iraq, also collected donations to send him a care package.

#36

Performance Microstructure Relationships of Batteries with Anodes Made Using Aqueous and Non-Aqueous Binders

J. Cohen, S. Tang, C. Todd, M. Newsham, M. Pollock, J. Roper, D. Strand
The Dow Chemical Company, Midland, MI

The Dow Chemical Company has initiated research to understand the applicability of aqueous binders to make electrodes for Li-ion batteries. Several commercially available binders were used to make the anodes for batteries that were then examined and compared to batteries comparably made using typical non-aqueous binders. The microstructures of the anode particle-binder interfaces were analyzed using SEM and TEM, prior to, and following, testing of the batteries in order to understand and correlate the results obtained.

#37

Mineralization of Apatite as a Model for Bone

Jacob Zuker, Michael Lubitz, Mary Tecklenburg
Central Michigan University, Mount Pleasant, Michigan

Bone is made of a collagen fiber interspersed with an inorganic calcium phosphate material, apatite ($Ca_{10}(PO_4)_6(OH)_2$). A better understanding of the factors that control mineralization steps within the collagen matrix could lead to better therapies for bone diseases. Amorphous calcium phosphate (ACP) is proposed to be the precursor to apatite formation in bone. The project involved testing whether ACP transformed into an intermediate called octacalcium phosphate (OCP) before forming apatite. The solutions of calcium and phosphate were mixed and precipitates were collected at different time points and quenched by freeze-drying. The crystal form of the precipitates at these times was analyzed by Raman spectroscopy, x-ray diffraction, and scanning electron microscopy.

#38

Advanced Nonaqueous Liquid Electrolyte for High-Power/High Energy Li-ion Battery

Houxiang (Sean) Tang, Dee Strand, Ravi Shankar, David Wilson, Andy Pasztor, Peter Margl, T.C. Kuo, Chris Tucker, Mark Newsham.
Global R&D, The Dow Chemical Company, Midland, MI

Safety and other technical hurdles are limiting application of Li-ion battery technology in large cells for some fast growing applications such as vehicle electrification. Development of electrolytes with better safety and electrochemistry performance is an important part of the effort to address this technical challenge. This poster will present the on-going effort at The Dow Chemical Co. to develop advanced nonaqueous liquid electrolytes for large Li-ion batteries used in high power/high energy applications. The use of different capabilities and chemistry in addressing problems such as flammability, wettability and electrochemical performance will be discussed.

#39

Dendritic Polymer Coatings: A New Method to Reduce Fouling of Reverse Osmosis Membranes

Peter Carver, Abhijit Sarkar, Joseph Rousseau, Claire Hartmann-Thompson, Adrian Merrington Tracey Zang, Steven E. Keinath and Petar Dvornic
Michigan Molecular Institute, Midland, MI, and Dendritech Inc., Midland, MI

The single most important problem in commercial reverse osmosis systems today is the fouling of active membrane surfaces. It has been well documented that if this problem can be eliminated, the fluxes of the purified water could be increased by as much as 30%, the life times of the membranes could be doubled, the need for periodic production shut down and membrane cleaning would be eliminated and the cost of the obtained potable water would be drastically reduced. Recently, dendritic polymers including dendrimers and hyperbranched polymers have been shown to be excellent building blocks for the preparation of unique crosslinked coatings with high antifouling activities. In this poster, we will present some new results obtained from a study of the effects of dendritic polymer coatings on the performance of selected commercial membranes aimed at reducing their surface biofouling.

Important Dates on the ACS Midland Section Calendar

Go to the website calendar for more details on the events below: http://membership.acs.org/m/midl/calendar.htm

Oct. 11	Open House: Tour of New Engineering Labs, SVSU
Oct. 18	2008 Sci-Fest, 10:00 a.m.-2:00 p.m., Delta College
Oct. 20	Midland Section board meeting, MCFTA, 7:00 p.m.
Oct. 24	Fall Scientific Meeting, MCFTA, 11:00 a.m.-5:30 p.m.
Oct. 29	MMTG lunchtime career development talk
Nov. 10	Deadline for December issue of *The Midland Chemist*
Nov. 17	ACS Tour Speaker, Tom Parliment, CMU Dow 170, 4:00-5:00 p.m.
Nov. 17	Midland Section board meeting, MCFTA, 7:00 p.m.

AMERICAN CHEMICAL SOCIETY
P.O. Box 2695
Midland, MI 48641-2695

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