Society of Plastics Engineers • Upper Midwest Section

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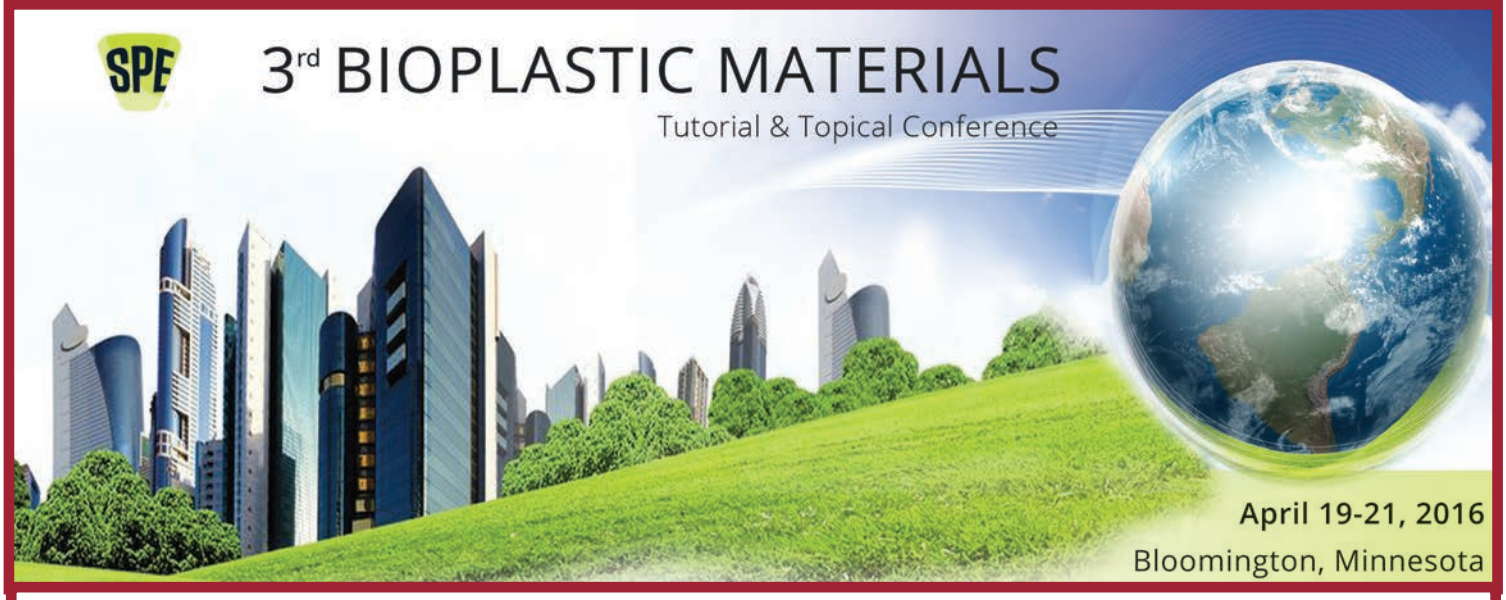
# THE SPECIALIST




The Upper Midwest Chapter of SPE and the Bioplastics Special Interest Group of SPE are pleased to announce

## The 3rd Annual Bioplastics Topical Conference and Tutorial.

This three day event will present the latest in bioplastics engineering, processing, and sustainability technologies.

### Tutorial - April 19

This one-day tutorial will provide practical information that will enhance your understanding of bioplastics. The tutorial is divided into two parts: Sustainability and Bioplastic Materials.

**Part 1: Bioplastic Materials: Overview - Edwin Tam Teknor Apex Company**

1. Classes of Biopolymers/Bioplastics
2. Chemistry
3. Typical Properties
4. Typical Markets & Applications

**Part 2: Sustainability Overview - Dr. Kelvin T. Okamoto**

1. Terminology and Definitions
2. Life Cycle Analysis
3. Regulations
4. Testing

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*Continued from front Cover*

# The 3rd Annual Bioplastics Topical Conference and Tutorial.

## Topical Conference - April 20-21

The conference will feature well known experts in the field of Bioplastics including materials, processing, testing, and more! Over 18 speakers will be presenting the latest in Bioplastics Technology.

## This year's keynote speakers include:

- **Dr. Ramani Narayan** - Michigan State University, Understanding Biodegradability - the science, hype & misuse and true value proposition
- **Dan Sawyer** - NatureWorks. Presentation Title: 3D Printing Polylactic Acid

## Who Should Attend

- R&D scientists and engineers, formulation scientists, process engineers, quality engineers and application engineers.
- Chemists and chemical engineers involved in development of biopolymers and bioplastics.
- Development engineers and research scientists working on new bioplastics developments.
- Bioplastics users and application specialists.
- Sales, Marketing, Market Development and Business Developments
- Students who are seeking a career in the Bioplastics design and processing industries

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**PLEASE DIRECT QUESTIONS** to Edwin Tam by phone 1-339-222-8076 or email at etam@teknorapex.com
**LOCATION / HOTEL:** Sheraton Bloomington Hotel, 5601 W. 78th Street, Minneapolis, MN 55439

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# President's Remarks *Shilpa Manjure*

Hello to everyone!! Can't believe we are already through the first quarter of the year and the Upper Midwest SPE is off to a glorious year already – first, a fabulous evening of awards & dining and secondly, two new additions to the Board!

The section hosted our seventh Annual Awards & Dinner Gala at The Seven restaurant in Minneapolis on Feb 19th. It was our pleasure to host and honor Prof. Chris Macosko from Chemical Engineering and Material Science Department at the University of Minnesota, as he was inducted into the Upper Midwest Hall of Fame. The program was ably organized by our Awards Chair, Dick Bopp and House Chair, Eric Swensied. The highlight of the evening was great networking between Professors, ex-students, other industry folks and academia, of course the food was fabulous and the show that followed at The Pantages was icing on the cake. The pictures included in the newsletter will allow you to catch a glimpse of the star-studded evening.

Another special awardee for that evening was our very own, Michael Arney. Michael is currently our Communications Chair and he has been a tremendous help in getting our website up to date, setting up email blasts and being editor for our SPEcialist. He was recognized with a President's Award for his exceptional dedication and service to the Upper Midwest Section. Please join me in congratulating and thanking Michael for his work!

Our next event for the year is The Bioplastics Topcon that we have been preparing for over the past year. Thanks to Sean Mertes for taking the lead on this event. The clock is now ticking towards the last few weeks and days. I wouldn't miss the opportunity to attend this one even if you are currently not working with bioplastics. It would be an excellent deal to attend the tutorial. One can get a quick overview of the materials and standards from none other than the current **Chairman of the ASTM committee on Environmentally Degradable Plastics and Biobased Products (D20.96), Kelvin Okamoto.**

The conference itself has two accomplished and internationally well-known **keynote speakers – Prof. Ramani Narayan and Dan Sawyer.** Prof. Narayan is considered the guru and pioneer of the bioplastics world and he is an extremely energetic and fluent speaker. I personally love to attend his talks. Dan is currently Global Leader, New Business Segment at NatureWorks, Llc and has worked with them for close to two decades. He will be speaking about application of PLA in 3D-printing – a cutting edge technology taking the world by storm with novel application ideas!!

We love to encourage our students in the section to attend and there are huge discounts this time as well! Another reminder for the students, Thomas McNamara, our Education Chair, has announced our Spring Scholarships. Please do check out more details on the application process further in this newsletter or our website.

Last but not the least; we would like to extend a warm welcome to our two new board members – Eric Hall and Joshua Weed. Eric will be joining as our Advertising Chair. He will be stepping in for Bill Priedeman, who did a tremendous job for the past 7 years and had to step down from the board last month. Joshua is not new to SPE. He was Vice-President of a student chapter in TX section and has returned for more volunteering. Thank you to both of you for your time!

If there are more interested members looking to support the educational efforts of SPE for our local section, please do contact me. Looking forward to meeting you at the Bioplastics TopCon. Happy Spring… enjoy the early season!

Best Regards, Shilpa Manjure

# SPE Education Committee - *Tom McNamara*

After providing 5 scholarships last Fall to very worthy students at UW-Stout, Winona State University, and Hennepin Technical College, your Upper Midwest Section Board of Directors has once again approved funding for Spring scholarships. The funding approved should cover the costs to support 4 or 5 scholarships. These scholarships will go to both 2-year and 4-year full time students in a plastics field of study. The 2-year students should be applying for the Tony Norris scholarship award while the 4-year degree students should apply for the Jerome Formo scholarship award. **APPLICATIONS ARE DUE APRIL 15** so do not delay. Please check the Upper Midwest Section website for requirement and application links.

In other news, a special arrangement had been made last year with the SPI organization to subsidize student SPE dues. Student membership dues were waived and SPI and SPE shared the membership cost for each student taking advantage of the offer. This offer is still in place.

Students receive free membership to SPE (Society of Plastics Engineers) and an electronic membership to SPI (Society of Plastics Industry) yearly when they join SPE or renew! Students who are US Citizens with primary residency in the US receive their complimentary membership by simply **joining** or **renewing online**. Just go to **www.4spe.org** and follow the membership instructions. All during the registration, it will look like you will be charged $31. However, at the end there will be a check box asking if you want SPI to pay the registration fee. If you check that box, the billing amount should zero. If you have any problems, contact membership services at SPE.

# Spotlight on the Board

**ERIC HALL**

Eric has been involved in the chemical an polymer industry for almost 30 years. He received a BS degree In Chemistry from the University of South Dakota, in Vermillion, SD, and then started his career with Cargill. Eric worked for 22 years at Cargill/NatureWorks, and during this time he participated in the development of polylactic acid, or PLA. He helped to grow the business from the initial lab work through the world's first commercial facility in Blair, Neb. After that, he joined start up named Draths Corp, where he worked on converting lysine to caprolactam. He then joined another local startup named Segetis, a biomaterials company developing and commercializing levulinic acid ketals and derivatives. He also spent 2 years with Medtronic, where he helped to develop a new kidney dialysis system. In November 2015 he started a venture called Renewable Solutions LLC. Renewable Solutions is a consulting and contract research company, focusing on chemical process development, polymer product development, and traditional consulting services. He specializes in scale-up and pre-commercial product development and sample preparation.

**JOSHUA WEED**

Joshua Weed is an Applications Engineer at NatureWorks LLC in Minnetonka, MN. Joshua began his higher education in Oklahoma at Oral Roberts University where he earned a degree in Mechanical Engineering in 2012. Joshua was fascinated with the mathematics behind rockets, engines, and control systems, as well as captivated with international travel – having spent a semester abroad studying at Uganda Christian University in Mukono, Uganda. He continued his education at Baylor University in Waco, Texas with Dr. Walter Bradley and Dr. William Jordan. While at Baylor, Joshua combined the exciting new research in natural fiber composites with an investment in developing countries through the field of Appropriate Technology. During his time at Baylor, Joshua was introduced to the Society of Plastics Engineers and served as its first President. Liaising with the South Texas Section of SPE, Joshua coordinated seminars, scholarships, and tours that introduced fellow students to companies like Space X, Waco Boom, Blackwell Plastics, and Texas Injection Molding. In July 2014, Joshua joined the R&D Technology Group at NatureWorks.

# SCIENCE CORNER

## Polylactic Acid Containing Fillers and Fibers

Dr. David E. Henton and Dr. Richard C. Bopp,
NatureWorks LLC, Minnetonka, MN 55345

### INTRODUCTION:

The grades of polylactic acid (PLA), as supplied by NatureWorks LLC, are not modified with fillers or fibers. The physical and rheological properties contained in the available specification sheets are those of the natural polymer and are representative of PLA in the amorphous or crystallized form, depending on the polymer grade. This document is designed to provide an overview, as well as a starting point, for end-users of PLA who would like to modify the polymer's physical or rheological properties with fillers or fibers. It is not intended to be a step-by-step procedure to obtain specific properties, nor be a processing guide for machine operation.

PLA has the ability to be stress crystallized, thermally crystallized, impact modified, filled, co-polymerized and processed in most polymer processing equipment. It can be formed into transparent films or injection molded into blow moldable preforms for bottles, similar to PET. PLA also has excellent organo-leptic characteristics and is excellent for food contact and related packaging applications. In addition, the starting material for the polymer, lactic acid, is made by a fermentation process from 100% annually renewable resources. The polymer will also bio-degrade in a compost environment and the byproducts are of very low toxicity, eventually being converted to carbon dioxide and water. The published literature on PLA is extensive and has been reviewed in detail in several recent publications[1-3].

### BACKGROUND:

Although PLA has an excellent balance of physical and rheological properties, many additives have been combined with it to further extend the range of properties achievable and thus optimize the material for specific end use applications. This document focuses on fillers and fibers. The most common fibers that have been combined with PLA are glass fibers and a limited selection of natural fibers including wood fibers, and certain annually renewable plant fibers such as flax and kanaf. Fillers that have been have shown to afford beneficial properties with blended with PLA include talc, mica, kaolin, glass (milled/flaked), a variety of inorganic carbonates and sulfates, as well as starch. Nanocomposites of PLA with various Angstrom sized inorganic particles and platelets have been reported in the literature,[4-5] but this technology is in the early stages of development and will not be covered in this document.

In order to derive the maximum benefit from the fiber or filler additives, several factors must be considered. Regardless of the additive, good (uniform) dispersion must be achieved. This is normally obtained by controlled addition of the additive during melt mixing in a twin screw extruder or high intensity batch mixing device.[6] Visual inspection can detect poor mixing, but often microscopy techniques are required to assure that the additives are not associated in macro-clumps which can lead to rheological problems or a decrease in toughness. Optimizing the extruder screw configuration, through-put rate, RPM, temperature and other process parameters are necessary with every formulation. The particle size of the filler is important and generally particle sizes from 0.1-12 m are used.[7] Smaller sizes have less detrimental effect on toughness and appearance, but generally cost more or can lead to dust handling problems.

Interfacial compatibility of the filler/fiber is also important in obtaining maximum benefits from the additive which will assist in dispersion and help minimize micro-defects in parts that can cause embrittlement. Coupling agents are often used with glass fibers[8] or coated fillers are used to enhance the interfacial adhesion of the additive to the matrix polymer. This is very common when polar additives are combined with non-polar polymers, but can be very useful in most systems. Silane and titinate coupling agents with various structures, depending on the polymer into which it will be blended, are often coated onto glass fibers and inorganic particulate fillers. These coupling agents can have beneficial effects on dispersion, toughness, rheology and often allow higher levels of incorporation.

### INCENTIVES AND BENEFITS TO INCORPORATE FILLERS AND FIBERS:

Generally, fillers or fibers are combined with PLA to either reduce the cost in the final part or modify the physical, rheological, or optical properties of the resin. Very low cost fillers are available and if they do not detract from the end use properties of PLA, they can be a very effective route to cost reduction. Starch is an excellent example, which is available at less than $0.10/pound and which retains the renewable resource characteristics of PLA while still being bio-degrad-



*SCIENCE CORNER continued on page 6*

able. Other drivers to incorporate additives include the need to improve the modulus (stiffness) at room temperature or elevated temperature. The room temperature modulus of all PLA resins can be increased by fillers or fibers, but only crystallized forms of polymers,[9] including PLA, show a significant improvement in practical use temperature with them. With some of the additives (e.g. talc), increased nucleation rates are obtained which can lead to both faster cycle times and increased crystallinity in parts and thus improved heat resistance.[10]

### PROBLEMS OR ISSUES WHEN INCORPORATING FILLERS OR FIBERS INTO PLA:

The desired beneficial effects from addition of fillers and fibers do not always come without some negative consequences. High levels of fillers/fibers can significantly increase viscosity, cause shear heating and degradation (MW loss and color formation), and affect the ability to fill thin walled parts. Appearance problems are also a potential with flow lines, poor colorability, and opacity being among the issues. Many fillers have high density and PLA filled with them will require more material to fill a part. Natural fibers contain high levels of moisture and drying them to prevent PLA molecular weight loss can be difficult. Also, adding high levels of natural fiber into the extruder requires side stuffers and close attention to the operation to maintain uniform operation. The batch-to-batch variation in natural fiber composition and quality can lead to consistency problems in the final blend. Finally, when considering applications that require compostability, the effect of the filler or fiber on the rate or extent of compostability should be evaluated.

### BLENDS WITH POLYSACCHARIDES

#### Starch:

A significant amount of work has been done optimizing PLA-starch blends for disposable and short term applications. Besides reducing costs, starch has been reported to act as a nucleating agent for PLA[11] as well as enhancing the heat resistance and modulus of the material. Generally compatibilization of the starch with the PLA is necessary to obtain an overall improvement in properties. Maleic anhydride grafted systems[12] and addition of third component compatibilizing polymers such as polyvinyl alcohol,[13-14] and polycaprolactone[15] have shown beneficial effects on the interfacial adhesion of the starch and improvement in properties. The level of the compatibilizer and its molecular weight affect the balance of properties in the blends. The effect of the amylose content of the starch in PLA blends has also been studied and high-amylose content starches enhance water absorption and probably accelerate bio-degradation.[16]

#### Cellulose:

Walnut shell flour, pine wood flour, and other sources of cellulose fiber have been blended with PLA at levels up to ca. 60% while increasing stiffness and obtaining up to 10 ºC improvement in heat resistance. Applications such as seedling planters for trees, which require bio-degradation in a short period of time are ideal applications for these filled products.[17] For both injection molding and extrusion/thermoforming, short fibers of less than 1 mm in length were found to perform best, however with kenaf fibers, lengths up to 20 mm have been reported to result in improved properties, using the best portion of the fiber[18]. Commercial products have already been introduced combining PLA and natural fibers. Toyota introduced an automobile called the Raum, in May 2003, with parts made of a plastic dubbed “Eco-Plastic,” produced by combining kenaf fibers and polylactic acid. The material, developed jointly by Toray and Toyota, is used for the vehicle’s spare tire cover as well as floor mats[19]. To increase the compatibility of natural fibers with PLA, the fibers should be degreased and chemically modified on the surface by acylation or coated with silane coupling agents[20]. Flax-PLA composites are reported to have significantly better properties than flax-polypropylene composites and have the environmental advantage of being based on 100% renewable resources[21]. Other approaches to incorporate cellulose fiber include the use of up to 25% recycled paper, blended at a melt temperatures up to 230 °C resulting in a pressed sheet with good stiffness and appearance[22].

#### Blends with Inorganic Fillers:

Generally when PLA is filled with inorganic materials such as talc, mica, glass, etc., the system is formulated with multiple other components to optimize a balance of physical properties, processing characteristics, and appearance for specific end use applications. For example, it has been proposed that compositions for disposable cards can consist of 5-85% PLA, 5-50 % of an aliphatic polyester, 10-45% polycaprolactone, and 5-300 parts of fillers such as talc[23]. It is common to utilize the “concentrate” approach for more efficient dispersion, where the filler or antiblocking agent is first dispersed at a higher concentration, often in another polymer or with the use of dispersing agents such as decaglycerol oleate, and then let down to the required concentration in the PLA[24]. SiO2 of very small particle size (< 0.05 µm) has been dispersed at levels up to 40% without clumping by this approach while still maintaining a haze of less than 1% in 15 µm, non-blocking films when let down to lower levels. Both talc and mica can be used to increase the modulus of PLA with 10-30% added. Mica is

effective at lower levels, but talc also acts as a nucleator, which is advantageous in fast cycle injection molding applications such as cutlery[25]. Flame retarded PLA compositions have been prepared by combining PLA with a variety of fillers, flame retardants, and additional components. For example, high levels (50-150 parts) of surface treated (silanes/titinates) metal hydroxides were combined with additional fillers (talc, kaolin, mica, glass, etc.) and toughening agents to produce a composition for domestic appliances[26]. Properties of injection molded PLA containing some inorganic fillers are presented in the following table. Most fillers increase the stiffness of PLA with little benefit to toughness. The acicular calcium carbonate, EMforceTM Bio at 30%, resulted in a surprisingly ductile failure with high energy adsorption[27].

Properties of Filled PLA

| | Flex Modulus (psi) | Dart Impact @ 23°C | IZOD Impact[c] (ft.lbs) | |
|---|---|---|---|---|
| | | | Notched | Un-notched |
| Specialty Minerals MTAG**D**609 Talc @ 1.5% | 571,936 | 2.3 | 0.8 | 6.2 |
| Specialty Minerals MTAG**D**609 Talc @ 10% | 726,130 | 2.1 | 0.5 | 5.1 |
| Specialty Minerals MTAG**D**609 Talc @ 30% | 1,342,439 | 1.3 | 0.5 | 3.3 |
| Vicron [a] 15-15 $CaCO_3$ @1.5% | 552,943 | 2.0 | 0.6 | 5.1 |
| Vicron 15-15 $CaCO_3$ @10% | 622,236 | 2.4 | 0.5 | 5.4 |
| Vicron 15-15 $CaCO_3$ @30% | 813,718 | 2.4 | 0.6 | 3.5 |
| Specialty Minerals Mica 5040 @1.5% | 581,908 | 2.3 | 0.6 | 4.8 |
| Specialty Minerals Mica 5040 @10% | 778,865 | 2.6 | 0.5 | 3.7 |
| Specialty Mica 5040 @30% | 1,433,271 | 1.6 | 0.6 | 2.3 |
| Synthetic silicate @1.5% | 559,541 | 2.7 | 0.6 | 5.7 |
| Synthetic silicate @10% | 630,742 | 2.2 | 0.5 | 4.0 |
| Synthetic silicate @30% | 836,343 | 1.8 | 0.4 | 2.1 |
| EMforce™ Bio [a] @1.5% | 562,600 | 2.4 | 0.6 | 3.8 |
| EMforce™ Bio @10% | 647,000 | 2.5 | 0.6 | 3.2 |
| EMforce™ Bio @30% | 825,470 | 19.8 | 2.3 | 5.5 |
| Unmodified NatureWorks™ PLA 4032D | 530,039 | 3.0 | 7.4 | 4.4 |

a. Trademark of Specialty Minerals. b. ASTM D 790. c. ASTM D 256-92

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# Macosko and Arney Honored at the 7th Annual Awards Gala

*By Dick Bopp, Awards Chair*

**Dr. Chris W. Macosko** and **Dr. Michael Arney** were both honored at the 7th Annual Awards Gala sponsored by the Upper Midwest Section of the SPE on Friday, February 19, 2016. The award ceremony followed a reception and dinner at the Seven Steakhouse & Sushi Restaurant in Minneapolis on Friday, February 19th. After dinner the honorees and guests were offered the opportunity to attend a revival of a 1959 musical, Gypsy, at The Pantages Theatre next door.

**Dr. Shilpa Manjure**, president of the Upper Midwest Section, inducted Dr. Macosko into the Upper Midwest SPE Hall of Fame for his distinguished career as an award winning educator and researcher in polymer science and engineering. During the ceremony, Dick Bopp, Awards Chair, commented on Prof. Macosko's many honors and achievements. Dr. Macosko is a world renowned pioneer in the field of polymer rheology, a Professor of Chemical Engineering & Materials Science at the University of Minnesota-Twin Cities Campus, a co-founder of Rheometics, Inc., and an active member of the SPE since 1971. Dr. Macosko was named the Minnesota Young Engineer of Year by the SPE and State of Minnesota in 1977. In 1997, Chris was elected Fellow of the Society of Plastics Engineers; and in 1999 he was awarded the International Award by the SPE, and in 2004 he was awarded the Bingham Medal by the Society of Rheology. Chris has amassed over 500 publications including 2 books and 7 book chapters and is the inventor or co-inventor on 10 patents. After the award presentation Chris made some brief remarks with slides describing the beginnings of his career at the U of MN, graciously acknowledging the contributions of his family, students, colleagues and mentors to his accomplishments--many were on hand to offer their support and best wishes.

President Manjure also conferred The President's Award to Dr. Michael Arney, Newsletter & Website Chair, for his outstanding work in overseeing all primary communications for the Section, including email blasts for our many events to SPE members and the plastics community. Michael is in many ways the "face" of the Section for which we all can be very proud. In recognition of this achievement, his name is added to a special plaque listing the names of all Presidents' Award winners which was arranged by **Tom McNamara**. It will be displayed at the upcoming Bioplastics Topcon and future Section events.

In closing, I would like to thank **Shilpa Manjure, Tom McNamara, Michael Arney, Eric Swensied** and **Sam McCord** for their important contributions to the success of this awards event…and to all of you who attended in support of Chris Macosko and Michael Arney's outstanding contributions to SPE and our industry. Thank you, all.

Dr. Chris Macosko Inducted into SPE Hall of Fame

Dr. Michael Arney receives Presidents' Award

# Councilor's Corner

***Tom McNamara*** - Councilor - Upper Midwest Section

First, I would like to take this opportunity to congratulate Dr, Chris Macosko on his induction into the Upper Midwest Section Hall of Fame. Dr. Macosko is very deserving with a career full of exemplary credentials and we are proud to have him as a 40+ year member of our Section.

Second, I would like to thank Dick Bopp for filling in for me as my proxy at the Fall councilor's meeting in Pittsburgh. Dick did a great job in his participation and reporting to our Section in the last SPEcialist newsletter. Thanks much Dick!!

The Winter council meeting was a remote (call-in meeting) held on February 5. Some of the highlights (or lowlights) are as follows:

**2015 Financial Results (unofficial) –**

• Net loss of $7K, which is quite an achievement considering a $223K loss on Foundation and SPE investment funds due to market conditions coupled with $350K loss of income from ANTEC exhibitions due to last year being an NPE co-location year.

• Comparing 2015 to 2014

- Membership revenue is was down $127K
- Advertisement / sponsorships were up 30%
- 2015 was an NPE year thus the $350K loss of exhibit income
- Publications were stable
- Marketing expenses were down 25% vs 2014
- Governance expenses were down 20% vs 2014
- Operations (salaries and IT) expenses were up 6%

**Bylaw and Policy changes:**

• Bylaw and termination change was effected for new e-member grade to state that the Chief Staff Executive or designate may execute the termination.

• Two policies had additions to include Sections or Divisions that by State law does not allow them to open their own bank accounts to contact SPE staff to set up money collection and expense reimbursement procedures

**Electronic Voting of SPE Officers**

This year there is a change in procedure for electing the officer positions with SPE Intl. Traditionally all officer positions were elected by written ballot at the ANTEC council meeting. This year the voting will be done electronically prior to the ANTEC Meeting. President-Elect will be voted on April 4, Senior VP will be on April 11, and VP will be on April 18.

**SPE Governance Reform**

SPE Intl has formed a Governance Task Force (GTF) to propose a new governance model for our Society. With most technical professional societies struggling with declining memberships (revenues), increasing expenses, lack of corporate support for individual memberships, and increasing access to technical data and information through electronic media, SPE feels it must look at alternate means of governance to make the Society more responsive to member needs. We must increase the member value to remain viable as an educational resource to our members and provide a more attractive offering to reverse the trend of declining memberships.

The GTF is proposing a Governance Board (GB) that would replace the existing Executive Committee (EC). It would be made up of 10 positions plus the Chief Staff Executive. The members would be representatives from Sections, Divisions, and Young Professionals with cross functional roles defined by appropriate job descriptions. The positions would be elected by Council or the members at large and have two year terms. The Chief Staff Executive would remain in charge of the staff but report to the GB. The Governance Board would be responsible for governance of the Society with the Council focusing on best practices and shared interests. The Council would retain ultimate authority to ratify or overturn governance actions. The GTF will continue to refine the new model, which is designed to provide longer range planning and improved representation to our membership. Council will vote on approval in the final version.

Last but not least, please stay involved with our Section by attending the numerous events such as our Mega and MiniTechs, plant tours, golf outings, and awards gala. As always, our Upper Midwest Section Board members are open to suggestions on how we can improve our offerings and educational opportunities. Feel free to contact any of our Board members at any time.

## WELCOME TO OUR NEW MEMBERS - Hamid Quraishi, Membership Chair

We are pleased to welcome our newest members of the Upper Midwest Section. As of March 15, 2016, our section has 312 active members! Tell your friends and co-workers about the SPE Upper Midwest Section to help us grow and check out our website, www.uppermidwestspe.org, and the national website, www.4spe.org, to know all that SPE and this section has to offer

| New Member | Affiliation |
|---|---|
| Shane Allen | Uponor |
| Patrick Jacobson | ADO Products, Inc. |
| Alex Mannion | University of Minnesota |
| Neal Adam | Allied Plastics |
| Carsten Koch | University of Wisconsin Madison |

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*April 2016*

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## CALENDAR OF EVENTS

BIOPLASTIC MATERIALS TOPCON.....April 19-21, 2016

ANTEC .....May 23-25, 2016

ANNUAL GOLF OUTING .....August 2, 2016

## Upper Midwest Section (S22) Membership

*April, 2016*

**Section Total ..... 312**