



ADDITIVE MANUFACTURING

Special Interest Group

Mission

The mission of our group is to provide a forum to present, promote and educate the SPE community in AM/3DP in the following areas:

- Material Development
- Equipment
- Process Technologies
- Product Design
- Mold + Mold Making
- Marketing
- Research + Development

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Photo courtesy of HP



Photo courtesy of Stratasys

Message from the Chair

Hello all, and welcome to the debut newsletter issue of the Society of Plastics Engineers (SPE) Additive Manufacturing/3D Printing (AM/3Dp) Special Interest Group (SIG)!



I am Matthew Thompson, the current SIG Board Chair. I am excited to introduce to you several of the efforts of our group, including our additive manufacturing technical presentations for SPE ANTEC 2020: The Virtual Edition, our Board of Directors who have been at work the past few years to make this group a success, and our Design for Additive Manufacturing (DfAM) workshops.

I want to give great thanks to Edwin Tam and Jack Dispenza for their leadership in starting and sustaining this SIG. Please see their Messages from Past Chairs in the next section.

Perhaps you have heard of AM/3Dp? Considering the hype and the press in the



Photo courtesy of Carbon, Inc.

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last decade, and considering you are reading this newsletter, I know you have. Hopefully you have had a chance to tune into the AM sessions at ANTEC in the last several years. Thanks in no small part to the efforts of this group, we have continued to bring high-quality content to the ANTEC technical sessions, and that will be no different this year. The format, however, will be quite different! I am proud of SPE for making the most of a difficult situation by bringing for the first time ANTEC 2020: The Virtual Edition. Please watch your emails and visit 4spe.org/antec for more information about this exciting virtual event. You can find a listing of the AM technical presentations that are planned this year later in this newsletter.

The mission of our SIG is shown on the cover of this newsletter: We aspire to bring you the latest news and technology for additive manufacturing and serve as a forum to connect you to what you need and to each other. We have an excellent Board of Directors who have been diligently working to set the foundations for this group and build the framework which will help us achieve that mission. I want to say thank you to all of our current and former Directors. They are listed later in this newsletter, and feel free to reach out to us with any questions or suggestions. We look forward to increasing our communication to the SIG membership and improving our services and activities that we will bring to you, including educational content, website resources, technical sessions at conferences, networking opportunities, and more.

Finally, I want to highlight one of the great events that we co-hosted and plan to continue into the future, which is called the Design for Additive Manufacturing (DfAM) Workshop. We co-hosted the first of these along with the SPE Product Design and Development Division in Portland, OR, on October 26, 2018. This was a great success, as described later in the newsletter, and we hope to partner with local SPE sections around the country to host more of these in the future.

Please reach out to me if you have any suggestions

Board of Directors

- Annette Lund, Vice President, Corporate Secretary, and Employee Stock Ownership Plan Trustee, Diversified Plastics, Inc., Minneapolis, MN
alund@divplast.com



- Jason Lyons, PhD, Business Manager – Kepstan, Arkema, King of Prussia, PA
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- Debora Massouda, PhD, AM SIG Secretary, Founding Member, Director and Vice President, Science, Technology and Research Institute of Delaware (STRIDE), Newark, DE
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- Dana McCallum, Head of Production Partnerships, Carbon, Redwood City, CA
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- Kalman Migler, PhD, AM SIG TPC 2019, Project Lead, Polymers Additive Manufacturing + Rheology, NIST, Gaithersburg, MD
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- Ray Pearson, PhD, Professor, Material Science + Engineering, Director, Center for Polymer Science and Engineering, Lehigh University, Bethlehem, PA
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on any of these activities of our SIG, and if you are interested in serving on our Board of Directors, we currently have some openings available by application. Enjoy, and keep making stuff!

Best regards,
Matthew

Matthew Thompson, PhD
SPE AM SIG Board Chair 2019-2020
Manager, Technical Service, Toray Composite Materials America
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2. Message from the Past Chairs

Message from Edwin Tam, SPE AM SIG Past Chair, 2015 - 2017

Dear Additive Manufacturing/3Dp SIG members,

Our journey began in 2015 with the formation of the Additive Manufacturing/3Dp Special Interest Group (SIG). This group is a spin-off from New Technology Forum (NTF) Committee. This is due to the overwhelming interest and attendance of the NTF Additive Manufacturing sessions at ANTEC. Our mission is to provide a forum for SPE members as well as non-SPE members to present, promote and educate the SPE Community in Additive Manufacturing/3D Printing in the areas of materials development, equipment, process technologies, product design, mold and mold making, marketing, and research & development. Our mission will be accomplished by:

1. Continuing to recruit new SIG members and Board members.

Board of Directors

- Edwin Tam, AM SIG Membership Committee Chair, AM SIG Board Chair 2015-2017, Director, Marketing, and New Business Development, Teknor Apex Company, Pawtucket, RI etam@teknorapex.com



- Matthew Thompson, PhD, AM SIG Board Chair 2019-2020, AM SIG TPC 2017, Director, SPE Southern Section, Manager Technical Service, Toray Composite Materials America, Inc., Decatur, AL Matthew.thompson@toraycma.com



- David Tucker, AM SIG Vice Chair & TPC 2020, AM SIG TPC 2018, Board Member, SPE Product Design and Development Division (PD3), Automotive Strategy and Production Development Manager, HP, Detroit, MI davidtucker@hp.com



- Shu-Kai Yeh, PhD, Associate Professor, Material Science and Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan skych@mail.ntust.edu.tw



2. Collaborating and arranging joint sessions with other divisions of SPE.
3. Collaborating with other industry Additive Manufacturing groups.
4. Organizing tutorial sessions and/or topical conferences (TOPCONs).

Today our membership has grown to 2,486 members with 47% being professionals and the rest being 25% students, 20% new young professionals, and 6% young professionals. Of our members, 79% are from North America. The top 10 states our members call home are as follows:

Rank	State	Number of Members	Fraction of Total SIG Membership
1	Michigan	215	9%
2	Texas	160	6%
3	Pennsylvania	147	6%
4	Ohio	143	6%
5	California	119	5%
6	Wisconsin	111	4%
7	Massachusetts	92	4%
8	Minnesota	78	3%
9	Illinois	74	3%
10	New York	57	2%

I have to say that to this time we have built a very strong Board of Directors and leadership; we have representation from SPE leadership, industry, government labs, as well as academics. Finally, we also have the growing support of our SIG members as shown in our fast growing membership numbers. We believe that together, with the same enthusiasm and determination, we can continue to build a strong SIG and hopefully later, a strong Division for SPE. As the founding Chair and current Membership Chair, thank you for your continued support.

Regards,
 Edwin Tam,
 SPE AM SIG Founder, Past Chair (2015-2017), and current Membership Chair
 Director, Marketing and New Business Development,
 Teknor Apex Company

Message from Jack Dispenza, SPE AM SIG Past Chair, 2017-2019

The dynamics of the plastic industry can present just as many benefits as challenges. As we look at the Mergers & Acquisitions (M&A) activity, outsourcing, tariffs, new materials, digital manufacturing and emerging technologies, we need to view these disruptions positively to create new trade space. The global manufacturing market is estimated to be \$12 trillion with the formative molding (injection, extrusion, vacuum forming, blow molding and others) market valued at approximately \$600 billion with half that value being the injection molding business. The additive manufacturing or 3D printing (3Dp) market alone is estimated to be \$8 billion by year's end. The questions are:

- “With many advancements in formative molding, how much will revenue grow in the next few years?”
- “How much revenue will be obtained by additive manufacturing/3D printing in the next few years?”
- If the formative and additive market shares were to increase by just 5%, the plastics market could easily exceed \$600 billion in value.

As always, we need to view disruptive and emerging technologies as opportunities. The common thread through additive, formative and subtractive (CNC machining) production is digital manufacturing. Digital manufacturing is an integrated approach to mold, print or machine parts using computer systems. These computer systems model, simulate and analyze during the design phase and process monitor, slice and print or numerical-control machine (CNC) parts in the production phase. Digital manufacturing shares the same goals as design for manufacturing (DFM) and computer-integrated manufacturing (CIM).

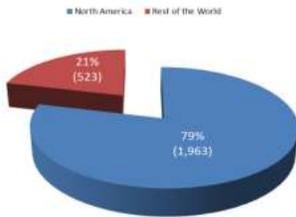
Additive manufacturing puts plastics in anyone's hands from the home and small design offices to the largest of enterprises. We have numerous additive processes to choose from beginning with stereolithography (SLA) and Fused Deposition Modeling (FDM) for prototyping and short runs to Multi Jet Fusion (MJF) and Lubricant Sub-Layer Photo Curing (LSPc) for higher throughput and volumes. Engineers can choose from thermoplastic and thermoset materials in many forms from filaments and powders to photopolymers. Also, additive equipment ranges from very affordable, table top Cartesian and delta printers to large area additive manufacturing SCARA robots. Too many exciting technologies to list here!

The SPE Additive Manufacturing Special Interest Group (AM SIG) Board of Directors is here to help. Our Board is made up of 3D printing and digital manufacturing industry professionals in automotive, aerospace, equipment, raw material suppliers, piece part design, defense, consumer products and academia. Our mission is to educate and assist membership with advancing and integrating the many additive technologies in product development and manufacturing. We serve all disciplines in our

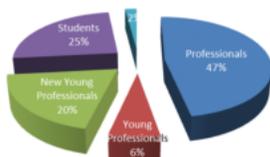
SIG Membership Information

Our membership demographics:

SPE Additive Manufacturing/3Dp SIG Membership
Total: 2,486



SPE Additive Manufacturing/3Dp SIG Membership Classifications
Total: 2,486



Our members are classified as:

- Professionals
- New Young Professionals
- Young Professionals
- Students

diverse industry through not only the AM SIG but also through our Technical Divisions, the geographic Sections and at various events, webinars and the diverse Annual Technical Conference (ANTEC). Looking forward to another great AM SIG year and meeting many of you.

Regards,
Jack

Jack Dispenza
SPE Fellow
SPE AM SIG Past Chair (2017-2019)
SPE Palisades-New Jersey Section Past President
Founding Engineer/Technical Manager, Design Results, LLC

3. Welcome New Board Members + Thank You to Former Board Members

We want to offer a warm welcome to our newest Board of Directors member Dana McCallum! Dana's application for the AM SIG Board was accepted in August 2019, and we are excited to have join the group. She brings ample enthusiasm and direct AM experience. She currently serves as Head of Production Partnerships at Carbon, and she has formerly served as VP of the Additive Manufacturing Users Group (AMUG) and Marketing Manager at Thogus and rapid prototype & manufacturing (rp+m).

Many thanks go out to the AM SIG Board of Directors members who have moved on from the group for their support and contributions. They include the following (if we missed anyone, please let us know!):

- James "Jim" Griffing, Director SPE Composites Division, a former President of SPE (2012-2013), retired Technical Fellow of The Boeing Company, served

2015-2019, including as one of the founding SIG Board members and first SIG Secretary.

- Jake McDonough, PhD, currently Business Development Engineer, Arkema, served 2015-2017
- Rabeah Elleithy, PhD, currently Senior R&D Packaging Engineer, Taghleef Industries, served 2016-2019
- Darrick van Horne, formerly Technical Support/Sales Engineer, Diversified Plastics, Inc., served 2018-2019.

4. AM Efforts in Response to COVID-19

As we are all now affected by the pandemic of the novel coronavirus 2019 and its ensuing disease COVID-19, our hearts go out to those who have faced health and economic hardships, and we want to do our best to support those fighting on the frontlines of the battle against the virus. Plastics are playing an integral role in this, and specifically the agility of additive manufacturing (AM)/3D printing technologies is helping alleviate some of the supply chain challenges with medical personal protective equipment (PPE) and devices.

We are proud of the AM community, including individuals and organizations, for arising to help in ways that it can. News articles and social media have been reporting about many efforts to 3D print face shields, alternative designs of protective masks, nasal test swabs, ventilator parts, and even alternative ventilator designs. Several of them are reported in the following for further reading (not an exhaustive list):

- 3dprintingmedia.network
- forbes.com
- making.engr.wisc.edu/shield
- coventchallenge.com
- carbon3d.com/covid19
- hp.com
- stratasys.com
- formlabs.com
- hscweb3.hsc.usf.edu.

One of the challenges will be matching the places with the most need to the alternative supply options with capacity. We encourage readers with known needs, known extra supplies or capabilities, or other information or interest to speak up on SPE's online forum called The Chain. A specific community was established called "SPE in Action – The Battle against COVID-19". Go to thechain.4spe.org (requires SPE member sign-in) and click the link at the top.

5. Workshops: Design for Additive Manufacturing (DfAM)

On October 26, 2018, the SPE AM SIG co-hosted a workshop with the SPE Product Design and Development Division called “Print Your Future: Plastics DfAM Workshop” in Portland, OR. Many thanks to David Tucker, who serves with both the AM SIG and PD3, for his instrumental role in the workshop. At the workshop, attendees learned about the manufacturing processes and applications of the technologies from HP, Carbon, Plural, Formlabs, and Altair. The day also featured collaborative small group sessions to solve product development case studies using AM tools and techniques. The event was very successful to educate the 80 participants about when to choose additive manufacturing and how to use it. All of the profit from the event was used in donating four 3D printers, each featuring the SPE logo, to local schools.



The AM SIG is planning further educational content like the Design for Additive Manufacturing (DfAM) workshop which may include workshops, short courses, seminars, tutorials, and other events.

6. AM Technical Presentations at ANTEC 2020: The Virtual Edition

Due to countermeasures implemented to mitigate the rate of the spread of COVID-19, SPE has arranged an alternative platform to accomplish the knowledge sharing portion of ANTEC 2020. Please visit 4spe.org/antec for more information and to register for ANTEC 2020: The Virtual Edition. Featured in this year’s ANTEC are two sessions for Additive Manufacturing as follows:

Additive Manufacturing I Monday, April 6, Afternoon

- 1:00-1:30 pm EDT, **Understanding the Limitations of 3D Printed Polymers through a Staged Screening Protocol**, Jessica Hemond, TE Connectivity
- 1:45-2:15 pm EDT, **Compressibility in Fused Filament Fabrication**, David Kazmer, PhD, University of Massachusetts-Lowell
- 2:30-3:00 pm EDT, **Investigation of Glass Bubbles iM16K Polyamide 12 Composites for Selective Laser Sintering**, James Klett, University of Wisconsin-Madison

- 3:15-3:45 pm EDT, **Development of an Agile, Battlefield Additive Manufacturing Plant for Recycled PET**, Prabhat Krishnaswamy, PhD, Engineering Mechanics Corp. of Columbus
- 4:00-4:30 pm EDT, **3D Printed Hybrid Composite Structures – Design and Optimization of a Bike Saddle**, Alec Redmann, University of Wisconsin-Madison
- 4:45-5:15 pm EDT, **Electro-Spun PVP (Polyvinylpyrrolidone) Nanofibers: An Experimental Investigation**, Utkarsh, Ontario Tech University

Additive Manufacturing II
 Tuesday, April 14, Morning

- 8:00-8:30 am EDT, **The Influence of Laser Power Variation on SLS-Printed PA6 Parts and Their Long-Term Properties**, Tobias Heckner, Robert Bosch GmbH
- 8:45-9:15 am EDT, **Enhancement of Binding Matrix Stiffness in Composite Filament Co-Extrusion Additive Manufacturing**, Chethan Savandaiah, Kompetenzzentrum Holz GmbH
- 9:30-10:00 am EDT, **Reliability Evaluation of Conductive Tracks Integrated into Additively Manufactured Components**, Kaja Schmidt, Robert Bosch GmbH
- 10:15-10:45 am EDT, **Determination of Physical Properties of Fused Filament Fabrication Parts as Influenced by the Nozzle**, Justin Limkaichong, University of Massachusetts-Lowell
- 11:00-11:30 am EDT, **Design and Evaluation of Bicomponent Core-Sheath Die for 3D Printer Filament Feedstock Co-Extrusion**, Rebecca Ruckdashel, PhD, University of Massachusetts-Lowell



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7. Sponsors/Ads

Call for Sponsors



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in this field.

If you are SPE member, it is **free** to join!

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The Society of Plastics Engineers (SPE) Additive Manufacturing (AM) Special Interest Group (SIG) invites you to take advantage of an opportunity to capture advertising space in our outgoing communications to our **1000+ members**. Help align your company's image with advanced technology and future trends by submitting your logo or designed ads which will feature on the SPE AM SIG website, newsletter, and other communications.

AM, also referred to as 3D printing (3Dp), has been a buzzword for several years, and the SPE AM SIG was born from this excitement in 2015. We have been active in arranging and

running excellent and well-attended technical sessions at SPE's flagship annual technical conference and tradeshow ANTEC. This year will include three AM sessions, each featuring an invited keynote from the AM industry related to *Enabling Finished Parts from Additive Manufacturing Processes*.

As we prepare to launch our SIG's website and debut our first newsletter issue, we are seeking sponsors. Sponsoring companies will have their logos and/or ads featured on our outgoing communications, which will add marketing value to the companies and bring color to our content. Please also reach out to us if you have educational content, such as published articles or white papers, that you feel our membership would benefit in reading.

The following options are available:

1. Business card, 3.5" wide x 2" tall, \$100
2. Small, 4" wide x 4" tall, \$150
3. Medium, 4" wide x 6" tall, \$200
4. Large (Half Page), 8" wide x 5.25" tall, \$250
5. Full Page, 8.5" wide x 11" tall, \$500.

Rates cover the entire SPE year (July 1 – June 30). Payments are handled through 4spe.org, and credit card payments are accepted. Size limit for digital file is 700 kB. Ads will be featured on newsletters, website, and other communication.

Contact Matthew Thompson, SPE AM SIG Chair, matthew.thompson@toraycma.com, for more information or to secure a sponsorship spot.