Two Big Conferences—One Big City!

June 17–20, 2018
Grand Hyatt San Antonio

International Conference on Powder Metallurgy & Particulate Materials

Additive Manufacturing with Powder Metallurgy

Visit POWDERMET2018.org or AMPM2018.org for program details.
Power of Powder®

Being the world leading manufacturer of metal powders means that we help open up a world of opportunities. Customers from a wide range of industries use our powders to reduce costs and environmental impact and we continuously drive development of new innovations beyond today’s markets.

Our facilities in the United States include full production and technical services to support a wide range of metal powder applications. The powder range consists of plain iron, gas-atomized and electrolytic iron powders as well as pre-alloyed, diffusion bonded, stainless and tool steels.

➤ Inspire industry to make more with less.
TECHNICAL PROGRAM
Full conference registration provides access to both POWDERMET2018 and AMPM2018 technical sessions. Over 200 worldwide industry experts will present the latest in powder metallurgy, particulate materials, and metal additive manufacturing. Visit POWDERMET2018.org or AMPM2018.org to find the latest conference program with complete abstracts, a schedule of events, and an exhibitor listing.

EXHIBIT
Over 100 booths showcasing leading suppliers of powder metallurgy and particulate materials processing equipment, powders, and metal additive manufacturing products.

SPECIAL CONFERENCE EVENTS
Including special guest speakers, luncheons, the Opening Night Reception, the PM Evening Alehouse, and the Closing Event—Boots and Blue jeans: A Texas BBQ.

Sponsored by:

Metal Powder Industries Federation
APMI International

Membership in either organization is not required for conference participation.

MPIF is an international federation of independent and related trade associations representing companies engaged in various aspects of the powder metallurgy and particulate materials industries. MPIF includes the following trade associations:

- Powder Metallurgy Parts Association
- Metal Powder Producers Association
- Powder Metallurgy Equipment Association
- Refractory Metals Association
- Metal Injection Molding Association
- Association for Metal Additive Manufacturing

APMI International is a worldwide technical society for professionals interested in developments in powder metallurgy and particulate materials technology.

REGISTER ONLINE AT POWDERMET2018.org or AMPM2018.org

2018 International Conference on Powder Metallurgy & Particulate Materials

Additive Manufacturing with Powder Metallurgy—2018

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SUNDAY, JUNE 17
8:00 a.m.–2:00 p.m.
APMI Golf Tournament
Brackenridge Park Golf Club
(Open to all attendees. Separate registration fee applies. Transportation departs from the Grand Hyatt San Antonio lobby at 7:00 a.m.)

8:00 a.m.–5:00 p.m.
EXHIBITOR SETUP

2:00–6:00 p.m.
POSTER DISPLAY
(Author setup)

Noon–6:00 p.m.
REGISTRATION OPEN

6:00–7:30 p.m.
OPENING NIGHT RECEPTION
Welcome to POWDERMET2018/AMP2018 and Historic San Antonio!
The conference begins with a casual opening-night event at the Grand Hyatt San Antonio. Food and beverages will be served as you renew acquaintances and network with your fellow PM/AM industry colleagues. Don’t miss the kick-off celebration as we welcome you to San Antonio!

MONDAY, JUNE 18
7:00–8:00 a.m.
SPEAKER PREP FOR MONDAY SPEAKERS

7:00 a.m.–5:30 p.m.
REGISTRATION

7:00 a.m.–5:30 p.m.
PUBLICATIONS BOOTH

8:00–9:15 a.m.
OPENING GENERAL SESSION
This conference opening session will feature welcome comments from MPIF Executive Director/CEO James P. Adams and MPIF President John Sweet, PMT. An overview of the annual MPIF State of the Industry report highlighting industry business conditions, technology trends, and the market for powder metallurgy and particulate materials will also be presented.

Keynote Presentation:
Automotive Outlook: Evolution or Revolution?
Casey Selecman
Associate Director, Advisory Services, IHS Markit
Disruptive forces are changing the automotive industry at a pace never seen before. Autonomous driving, electric vehicles, new mobility concepts, and vehicle connectivity are each challenging the traditional car and truck status quo. Casey Selecman will level set where the auto industry today is from a vehicle and powertrain perspective, and help frame out when these disruptors are likely to make a volume impact. A review of key technology adoption drivers such as legislation, consumer needs/wants, OEM capabilities, and infrastructure/energy will help ground the forecast analysis.

9:30–10:30 a.m.
POWDER METALLURGY PARTS ASSOCIATION
Board of Directors Meeting

9:30–10:45 a.m.
TECHNICAL SESSIONS
01: Refractory Reduction & Carburization
02: Design & Modeling I
03: Novel Sintering Processes I
04: Additive Manufacturing I

SPECIAL INTEREST PROGRAM
SIP 1-1: Advancements for High-Density Components

STUDENT POSTER SESSION
(See page 32 for details.)

9:30–11:45 a.m.
EXHIBIT OPENS
POSTER DISPLAY
AM CAFÉ: Coffee Served

1:45–6:30 p.m.
EXHIBIT OPEN
POSTER DISPLAY

1:45–2:45 p.m.
PM CAFÉ: Desserts Served

2:00–3:30 p.m.
POWDER METALLURGY PARTS ASSOCIATION
Membership Meeting
**TUESDAY, JUNE 19**

7:00–8:00 a.m.  
**SPEAKER PREP FOR TUESDAY SPEAKERS**

7:00 a.m.–5:00 p.m.  
**REGISTRATION**

7:00 a.m.–5:00 p.m.  
**PUBLICATIONS BOOTH**

7:30–8:30 a.m.  
**POWDER METALLURGY EQUIPMENT ASSOCIATION Membership Meeting**

8:00–9:15 a.m.  
**TECHNICAL SESSIONS**
13: Process Optimization  
14: Sintering Atmosphere Control  
15: PM Low-Alloy Steels  
16: MIM I: Materials

**SPECIAL INTEREST PROGRAM**
SIP 3-1: Tungsten & Refractory Metals: Cobalt-Free Refractory Metals—II

**STUDENT POSTER SESSION**

8:00–9:40 a.m.  
**AMPM CONFERENCE SESSIONS**
A07: Process Parameters and Structure/Property Relationships I  
A08: Nickel-Based Alloys  
A09: Design Consideration I

9:00–11:45 a.m.  
**EXHIBIT OPEN POSTER DISPLAY**

9:00–10:30 a.m.  
**AM CAFÉ: Coffee Served**

10:30–11:45 a.m.  
**TECHNICAL SESSIONS**
17: Process Monitoring  
18: Sintering Processes  
19: Atomization  
20: MIM II: Molding

**SPECIAL INTEREST PROGRAM**
SIP 3-2: Tungsten & Refractory Metals: Cobalt-Free Refractory Metals—II

**STUDENT POSTER SESSION**

5:00–6:30 p.m.  
**PM EVENING ALEHOUSE**

Sponsored by the Powder Metallurgy Equipment Association

MPIF and the Powder Metallurgy Equipment Association invite all registered delegates to the exhibit hall for 90 minutes of uninterrupted networking while you enjoy a local Texas brew. Walk through the hall and visit with exhibitors to find out more about their products and services. It is also a great opportunity to get your Exhibitor Game Card filled out for a chance to win one of our grand prizes!

Poster Authors will also be available for discussion.

**SPECIAL INTEREST PROGRAM**
SIP 2-1: Energy Generation & Storage Technologies—I

**STUDENT POSTER SESSION**

5:00–6:30 p.m.  
**EXHIBIT OPEN POSTER DISPLAY**

5:00–6:30 p.m.  
**PM EVENING ALEHOUSE**

Sponsored by the Powder Metallurgy Equipment Association

MPIF and the Powder Metallurgy Equipment Association invite all registered delegates to the exhibit hall for 90 minutes of uninterrupted networking while you enjoy a local Texas brew. Walk through the hall and visit with exhibitors to find out more about their products and services. It is also a great opportunity to get your Exhibitor Game Card filled out for a chance to win one of our grand prizes!

Poster Authors will also be available for discussion.

 Noon–1:45 p.m.  
**INDUSTRY LUNCHEON**
Recognizing PM Industry Achievements

The luncheon will recognize key industry individuals identified to receive major industry awards, among them the MPIF Vanguard Award Recipient Chad Spore, and APMI’s new Class of Fellows, Stephen Mashl and Alberto Molinari.

**STUDENT POSTER SESSION**

1:45–4:30 p.m.  
**EXHIBIT OPEN POSTER DISPLAY**

1:45–2:45 p.m.  
**PM CAFÉ: Desserts Served**

2:15–3:00 p.m.  
**CPMT SESSION**

2:15–3:30 p.m.  
**SPECIAL INTEREST PROGRAM**
SIP 3-3: Tungsten & Refractory Metals: Additive Manufacturing of Refractory Metals

2:15–3:55 p.m.  
**AMPM CONFERENCE SESSIONS**
A10: Powder Characterization III  
A11: Powder and Powder Production  
A12: Fused Deposition Modeling

3:30–4:00 p.m.  
**TECHNOLOGY SCAN: Machinery Sensors & Information Technology (MPIF members only)**
Tuesday continued

4:15–5:30 p.m.
TECHNICAL SESSIONS
21: Novel Materials
22: Surface Modification & Characterization
23: High-Complexity & High-Density Forming

SPECIAL INTEREST PROGRAM
SIP 3-4: Tungsten & Refractory Metals: Refractory Metals

STUDENT POSTER SESSION

AMPM CONFERENCE SESSIONS
A16: Process Parameters and Structure/Property Relationships III
A17: Aluminum Alloys I
A18: Dynamic Properties

6:30–10:00 p.m.
CLOSING EVENT—Boots and Blue Jeans: A Texas BBQ
Grab your cowboy boots, put on a pair of blue jeans, and join us for this one-of-a-kind Texas BBQ! The group will ride off to The Plaza & Lone Star Pavilion for a truly unforgettable night. Soak up the breathtaking views of Sunset Station, St. Paul Square, and the San Antonio skyline while enjoying a cold beverage during cocktail hour. For dinner, join us inside the Lone Star Pavilion for a delicious BBQ spread while listening and dancing to the live entertainment. Everything is bigger in Texas and the Closing Event is no exception—don't miss out on this fun, relaxing, and memorable event.

Wednesday, June 20

7:00–8:00 a.m.
SPEAKER PREP FOR WEDNESDAY SPEAKERS

7:00 a.m.–12:15 p.m.
REGISTRATION

7:00 a.m.–12:15 p.m.
PUBLICATIONS BOOTH

8:00–9:15 a.m.
TECHNICAL SESSIONS
24: Powder Characterization
25: Refractory Processing
26: Post-Sintering Operations/Industrial Gases

SPECIAL INTEREST PROGRAM
SIP 4-1: Machinability: New Considerations for PM Machining

STUDENT POSTER SESSION

AMPM CONFERENCE SESSIONS
A19: Process and Product Analytics I
A20: Aluminum Alloys II
A21: Post Processing of AM Builds and Powder I

9:30–10:45 a.m.
TECHNICAL SESSIONS
27: Sinter Hardening
28: Mechanical Properties
29: Lightweight PM Materials

SPECIAL INTEREST PROGRAM
SIP 4-2: Machinability: Machining Alternatives for PM Materials

STUDENT POSTER SESSION

AMPM CONFERENCE SESSIONS
A22: Process and Product Analytics II
A23: Aluminum Alloys III
A24: Post Processing of AM Builds and Powder II

11:00 a.m.–12:15 p.m.
TECHNICAL SESSIONS
30: Advanced Processing
31: Titanium Alloys

SPECIAL INTEREST PROGRAM
SIP 4-3: Machinability: Modeling and Practice of PM Machining

STUDENT POSTER SESSION

11:00 a.m.–12:40 p.m.
AMPM CONFERENCE SESSIONS
A25: Directed Energy Deposition
A26: Build Atmosphere Attributes
A27: Refractory Materials

12:30–1:30 p.m.
Conference Committee Meeting
(By invitation)

2:00–5:00 p.m.
ASSOCIATION FOR METAL ADDITIVE MANUFACTURING Membership Meeting

POWDERMET2018/AMPM2018 CONCLUDES
(Program, times and events subject to change)
New this year at POWDERMET2018 & AMPM2018

- POWDERMET2018 registration reduced $700
- Dual access to BOTH conferences
- Extended exhibit hall hours
  Increased non-compete time.
- AMPM2018
  An entire extra day of technical sessions.
  Full registration now includes the Closing Event.
- Student Poster Sessions
  Blocks of time for 40+ grant recipients to present
  their work.
- Exhibitor Game Card
  Win up to $500 in prizes!
- Return of the AM/PM Café
  Schedule face-to-face meetings.
- Showcase Awards
  PM Design Excellence Awards will be announced
  Monday—a day earlier than previous years—and
  on display in the exhibit hall for the rest of the
  conference.

Introducing the PM Evening Alehouse
Struggling to balance technical sessions with
time in the exhibit hall? Not anymore!
Monday evening’s social event features
90 minutes of networking in the exhibit
hall. Grab a beverage and shake hands with
exhibitors.
✓ Connect with your customers for
  face-to-face time.
✓ Network with attendees and speakers to
discuss the latest advancements in PM.
✓ Visit the Poster Display—a authors
  will be available for discussion.

Visit San Antonio!

River Walk
The San Antonio River Walk is a verdant oasis of
cypress-lined paved paths, arched stone bridges,
and lush landscapes. It gently winds through the
city center, providing millions of visitors each
year with easy access to the city’s cultural hot
spots, historic sites, and other attractions.

A Foodie Paradise
Taste the world here in San Antonio. Beyond
Tex-Mex are German bakeries, Mexican
cantinas, French bistros and Italian trattorias.
Flour from age-old European millstones
becomes a morning’s crepes or an afternoon’s
tortilla. Hill Country wines prove a silky foil
to smoky chipotle. Acclaimed chefs bring their
world class training back to San Antonio’s
blossoming culinary landscape.

Celebrate the Tricentennial
San Antonio is a city that
revels in performances, parties,
and its ever-colorful character.
2018 is filled with dynamic
events and special exhibitions
for a year-long Tricentennial
celebration. Join San Antonio
in paying tribute to their past
as they look forward to the
future.
Attend the PM industry's largest tradeshow devoted exclusively to powder metallurgy, particulate materials, and metal additive manufacturing. With over 100 booths, this international marketplace will present leading companies featuring the latest PM equipment, powders, products, and services.

Meet industry suppliers all together in one place.

**Here is what’s happening in the 2018 Exhibit Hall...**

**NEW—Extended Exhibit Hall Hours**
Open for over 12 hours, this year's hall includes nearly 7 hours of non-compete time.

**NEW—PM Evening Alehouse**
Enjoy a 90-minute networking reception while you tour the exhibit hall—cold beer in hand! Sponsored by the Powder Metallurgy Equipment Association.

**Exhibitor Game Card—Your Chance to Win Up to $500 Returns**
Complete your game card by filling in all 25 squares with stickers from different exhibitors. Turn in a completed game card for a Starbucks gift card and a chance to win one of three grand prizes!

**AM/PM Café—Keep the Networking Going...**
Meet up for a morning cup of coffee or grab dessert after lunch. Then, tour the exhibit hall.

**Poster Display—Bringing Learning into the Hall**
Poster authors will be on hand to discuss their posters during the PM Evening Alehouse. To hear even more from the student grant recipients, attend the Student Poster Sessions. (See Daily Schedule for details and times.)

**Showcase of Excellence—2018 PM Design Excellence Award Entries on Display**
All entries will be on display in the exhibit hall, with winning parts to be identified following Monday’s Awards Luncheon. This “Showcase of PM Excellence” provides an opportunity to review the latest PM engineering innovations and applications.
Exhibitors

3DEO, INC.
Los Angeles, CA

ABBOTT FURNACE COMPANY
St. Marys, PA

ABTEX CORPORATION
Dresden, NY

AIR PRODUCTS AND CHEMICALS, INC.
Allentown, PA

ALD VACUUM TECHNOLOGIES, INC.
East Windsor, CT

AMC POWDERS CO., LTD
Beijing, China

AMERICAN CHEMET CORP
East Helena, MT

AMETEK SPECIALTY METAL PRODUCTS
Eighty Four, PA

ASBURY GRAPHITE MILLS, INC.
Asbury, NJ

ATI POWDER METALS
Pittsburgh, PA

BASF CORPORATION
Evans City, PA

BLASCH PRECISION CERAMICS
Albany, NY

BRONSON & BRATTON, INC.
Burr Ridge, IL

CARPENTER TECHNOLOGY CORPORATION
Bridgeville, PA

CENTORR VACUUM INDUSTRIES, INC.
Nashua, NH

CINCINNATI INCORPORATED
Cincinnati, OH

CM FURNACES, INC.
Bloomfield, NJ

CNPC POWDER NORTH AMERICAN, INC.
Prince Edward Island, Canada

DORST AMERICA, INC.
Bethlehem, PA

EIRICH MACHINES, INC.
Gurnee, IL

ELNIK SYSTEMS, LLC
Cedar Grove, NJ

EOS OF NORTH AMERICA, INC.
Novi, MI

EQUISPHERES, INC.
Ontario, Canada

EROWA TECHNOLOGY, INC.
Arlington Heights, IL

EXONE
North Huntingdon, PA

FREEMAN TECHNOLOGY, INC.
Gloucester, United Kingdom

GASBARRE FURNACE GROUP
St. Marys, PA

GFMS/SYSTEM 3R
Lincolnshire, IL

GLOBAL ADVANCED METALS
Boyertown, PA

GLOBAL TUNGSTEN & POWDERS CORPORATION
Towanda, PA

GRANUTOOLS
Awans, Belgium

HARPER INTERNATIONAL
Buffalo, NY

HK TECHNOLOGIES, INC.
Salem, OH

HOEGANAES CORPORATION
Cinnaminson, NJ

IPS CERAMICS LTD.
Stoke-on-Trent, United Kingdom

KITTYHAWK PRODUCTS
Garden Grove, CA

KOMAGE GELLNER KG/WEST TECHNOLOGIES, LLC
Fairport, NY

KYMERA INTERNATIONAL
Union, NJ

LASERLINE, INC.
Santa Clara, CA

LINDE, LLC
Murray Hill, NJ

LINE CRAFT, INC.
Lombard, IL

LÖMI GmbH
Grossostheim, Germany

LUXFER MAGTECH
Manchester, NJ

MAKIN METAL POWDERS (UK) LTD.
Lancashire, United Kingdom

MALVERN PANANALYTICAL
Westborough, MA

NEFF PRESS, INC.
St. Louis, MO

NORTH AMERICAN HÖGANÄS, INC.
Hollspolle, PA

NOVAMET SPECIALTY PRODUCTS CORPORATION
Lebanon, TN

ORTON CERAMIC FOUNDATION
Westerville, OH

OSTERWALDER, INC.
Northampton, PA

PFEIFFER VACUUM
Nashua, NH

PLANSEER USA, LLC
Franklin, MA

PRAXAIR, INC.
Burr Ridge, IL

PRAXAIR SURFACE TECHNOLOGIES, INC.
Indianapolis, IN

PRECISION EFORMING
Cortland, NY

QUAL-FAB, INC.
Avon, OH

QUINTUS TECHNOLOGIES, LLC
Lewis Center, OH

RENSHAW, INC.
West Dundee, IL

RIO TINTO METAL POWDERS
Québec, Canada

ROYAL METAL POWDERS, INC.
Maryville, TN

RYER, INC.
Temecula, CA

SACMI USA LTD
Urbanbade, IA

SANDVIK OSPREY LTD
Neath, United Kingdom

SCHMIDT + CLEMENS GmbH + Co. KG
Lindlar, Germany

SGL CARBON, LLC
St. Marys, PA

SINTERITE, A Gasbarre Furnace Group Company
St. Marys, PA

SINTEZ SP LTD
Dzerzhinsk, Russia

SLM SOLUTIONS NA, INC.
Novi, MI

SUMCA SAS
Ambrières Les Valleees, France

TEKNA ADVANCED MATERIALS
Québec, Canada

THE ALLOY ENGINEERING COMPANY
Berea, OH

THE MODAL SHOP, INC.
Cincinnati, OH

TRIBOTECC GMBH
Waxhaw, NC

ULTRA INFILTRANT
Zionsville, IN

UNION PROCESS, INC.
Akron, OH

UNITED STATES METAL POWDERS
Palmerton, PA

VAC-U-MAX
Belleville, NJ

VERDER SCIENTIFIC, INC.
Newtown, PA

VIRTO GROUP
Reggio Emilia, Italy

VORTI-SIV/MM INDUSTRIES, INC.
Salern, OH

XIAMEN HONGLU TUNGSTEN-MOLYBDENUM INDUSTRY CO. LTD
Xiamen, China

ZIRCAR CERAMICS, INC.
Florida, NY

(Listing as of January 25, 2018)
POWDERMET TECHNICAL SESSIONS

CONFERECE CHAIRMEN:

Animesh Bose, FAPMI
Desktop Metal

Scott Davis
Hoeganaes Corporation

TECHNICAL FORMAT
Two to four technical sessions will take place concurrently.

Each session will consist of:
• Three technical papers presented by the author
• Individual presentation times will run 25 minutes, including questions

Manuscripts from the technical sessions will be included in the conference proceedings.

AMPM TECHNICAL SESSIONS

CONFERECE CHAIRMEN:

Todd Grimm
T.A. Grimm & Associates

Juha Kotila
EOS Finland

TECHNICAL FORMAT
Two to three technical sessions will take place concurrently.

Each session will consist of:
• Three to five technical presentations by the author
• Individual presentation times will run 25 minutes, including questions

Reproduction of the PowerPoint and submitted publishable manuscripts will be included in the conference presentations.

STUDENT POSTER SESSION

Students who receive the National Science Foundation Grant or the CPMT/Axel Madsen Conference Grant will present a 10-minute synopsis of their poster. Grant recipients and their poster titles will be available on the conference website.

SPECIAL INTEREST PROGRAM

Special Interest Program (SIP) presentations are cutting-edge R&D and typically oral in nature, but all submitted publishable manuscripts will be included in the conference proceedings.

RESTRICTIONS ON RECORDING

No photography, or audio or video recording of presentations is permitted.
### POWDERMET TECHNICAL SESSIONS

#### MONDAY, JUNE 18

**Session 01: Refractory Reduction & Carburization**

<table>
<thead>
<tr>
<th>Time</th>
<th>Country</th>
<th>Title</th>
<th>Author(s)</th>
</tr>
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<tbody>
<tr>
<td>9:30</td>
<td>Austria</td>
<td>Correlation of Reduction Condition and Molybdenum Dioxide Characteristics on the Evolving Mo Morphology During Hydrogen Reduction</td>
<td>Johanna Bolitschek, Montanuniversität Leoben</td>
</tr>
<tr>
<td>9:55</td>
<td>China</td>
<td>A Novel Deoxidation Method of Mo Powder by Redox Reaction</td>
<td>XianQin Wang, JinDuiCheng Molybdenum Group</td>
</tr>
<tr>
<td>10:20</td>
<td></td>
<td>No presentation scheduled at this time.</td>
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**Session 02: Design & Modeling I**

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<th>Time</th>
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<tbody>
<tr>
<td>9:30</td>
<td>USA</td>
<td>Close-Coupled Gas Atomization and Nozzle Gas Dynamics, Part (1): Visualization</td>
<td>Trevor M. Riedemann, Ames Laboratory (USDOE)</td>
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**Session 03: Novel Sintering Processes I**

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<th>Time</th>
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<th>Author(s)</th>
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<tbody>
<tr>
<td>9:30</td>
<td>USA</td>
<td>Coupled Thermo-Electric Fields Assisted Sintering of Copper Films</td>
<td>Daudi R. Waryoba, Pennsylvania State University</td>
</tr>
<tr>
<td>9:55</td>
<td>USA</td>
<td>Utilizing Magneto-Static Energy in the Fabrication of Full-Scale High-Performance Alnico Magnets with Near-Final Shape</td>
<td>Emily A. Rinko, Iowa State University</td>
</tr>
<tr>
<td>10:20</td>
<td>Canada</td>
<td>Novel Master Alloys Using Boron and Carbon as Liquid-Phase Promoters</td>
<td>Simon Gélinas, Université Laval</td>
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**Session 04: Additive Manufacturing I**

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<th>Time</th>
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<th>Author(s)</th>
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<tbody>
<tr>
<td>9:30</td>
<td>Canada</td>
<td>Impact of Powder Size, Size Distribution and Morphology on Additive Manufacturing</td>
<td>Mark Gallerneault, Equisphears</td>
</tr>
<tr>
<td>9:55</td>
<td>USA</td>
<td>Fused Filament Fabrication 3D Printing and Casting with Low-Melt Alloys</td>
<td>Kunal Kate, University of Louisville</td>
</tr>
<tr>
<td>10:20</td>
<td>USA</td>
<td>Considerations of 3D Printing Beyond the Industrial and Manufacturing Environment</td>
<td>Alison Gauthier, Exponent</td>
</tr>
</tbody>
</table>

### STUDENT POSTER SESSIONS

**Monday Morning**

**Session 05: Nano Materials**

**Session Chairman: Bo Hu**
As the demand for high-performance powder metallurgy (PM) applications grows, advancements in high-density component manufacturing are key for continued growth of the PM industry. Progression towards higher densities to enhance mechanical performance plays a vital role in the ability for PM manufacturing to compete against wrought and cast iron components. The recent developments in compaction and sintering technologies have opened up new possibilities to achieve higher densities. This program will focus on the advancement towards high-density component manufacturing using developments made in press-and-die set design, die wall lubrication systems, and sintering technologies.

Individual presentation times will run 25 minutes, including questions. Manuscripts that are submitted will be published in the conference proceedings.
### POWDERMET TECHNICAL SESSIONS

**Monday Afternoon 2:30–3:45 p.m.**

#### SESSION 05: Nano Materials
**Session Chairman:** Bo Hu, North American Höganäs, Inc.

<table>
<thead>
<tr>
<th>#</th>
<th>Country</th>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>256</td>
<td>USA</td>
<td>2:30 p.m.</td>
<td>Generating Bulk Parts of Nanocrystalline CuTa</td>
<td>Anthony J. Roberts, U.S. Army Research Laboratory</td>
<td>Howard, USA</td>
</tr>
<tr>
<td>205</td>
<td>USA</td>
<td>2:55 p.m.</td>
<td>Synthesis &amp; Characterization of Nanostructured Boron Carbide for Armor Applications</td>
<td>Chris D. Haines, U.S. Army ARDEC</td>
<td>Virginia, USA</td>
</tr>
<tr>
<td>132</td>
<td>Korea</td>
<td>3:20 p.m.</td>
<td>The Evolution and Stability of Nano-Sized Oxide Particles in Metal Alloys</td>
<td>Jinsung Jang, Korea Atomic Energy Research Institute</td>
<td>Korea</td>
</tr>
</tbody>
</table>

#### SESSION 06: Design & Modeling II
**Session Chairman:** Brian H. Pittenger, Jenike & Johanson, Inc.

<table>
<thead>
<tr>
<th>#</th>
<th>Country</th>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>140</td>
<td>USA</td>
<td>2:30 p.m.</td>
<td>Monitoring of Powder Homogeneity During Double-Cone Blending</td>
<td>Alex B. Wartenberg, Hoeganaes Corporation</td>
<td>Illinois, USA</td>
</tr>
<tr>
<td>119</td>
<td>Italy</td>
<td>2:55 p.m.</td>
<td>From Compaction Mechanics to Sintering Shrinkage of Rings with Different Height/Diameter Ratio</td>
<td>Alberto Molinari, University of Trento</td>
<td>Italy</td>
</tr>
<tr>
<td>178</td>
<td>India</td>
<td>3:20 p.m.</td>
<td>No presentation scheduled at this time.</td>
<td>-</td>
<td>India</td>
</tr>
</tbody>
</table>

#### SESSION 07: Novel Sintering Processes II
**Session Chairman:** Daniel P. Reardon, Abbott Furnace Company

<table>
<thead>
<tr>
<th>#</th>
<th>Country</th>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>095</td>
<td>USA</td>
<td>2:30 p.m.</td>
<td>Extraterrestrial Sintering</td>
<td>Randall M. German, FAPMI, San Diego State University</td>
<td>California, USA</td>
</tr>
<tr>
<td>207</td>
<td>USA</td>
<td>2:55 p.m.</td>
<td>Consolidation of Mechanically Alloyed Nanocrystalline Iron-Nickel-Zirconium Alloy Powder by Spark Plasma Sintering</td>
<td>Thomas Luckenbaugh, Bowhead Total Enterprise Solutions</td>
<td>Virginia, USA</td>
</tr>
<tr>
<td>178</td>
<td>India</td>
<td>3:20 p.m.</td>
<td>Use of Halide Solution to Improve the RDI and RI of Sinter: An Experience at JSPL</td>
<td>Sanjay Srivastava, Jindal Steel &amp; Power Ltd.</td>
<td>India</td>
</tr>
</tbody>
</table>

#### SESSION 08: Additive Manufacturing II
**Session Chairman:** Jessu Joys, United States Metal Powders, Inc.

<table>
<thead>
<tr>
<th>#</th>
<th>Country</th>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>061</td>
<td>USA</td>
<td>2:30 p.m.</td>
<td>Tribological Analysis of BAMalloy Coatings on Steel and Aluminum Applied via Laser Directed Energy Deposition</td>
<td>James L. Tomich, South Dakota School of Mines &amp; Technology—Additive Manufacturing Lab</td>
<td>North Dakota, USA</td>
</tr>
<tr>
<td>255</td>
<td>France</td>
<td>2:55 p.m.</td>
<td>Effect of Environmental and Mechanical Loading Conditions on Crack Initiation and Propagation at 650 °C in Laser Beam Melted Alloy 718</td>
<td>Alexandre Pancou, CIRIMAT</td>
<td>France</td>
</tr>
<tr>
<td>082</td>
<td>USA</td>
<td>3:20 p.m.</td>
<td>Localized Residual Stress Measurements Using Electron Microscopy</td>
<td>Kathryn A. Small, Drexel University</td>
<td>Pennsylvania, USA</td>
</tr>
</tbody>
</table>

### STUDENT POSTER SESSIONS

**Monday Afternoon 2:30–3:45 p.m.**
**SPECIAL INTEREST PROGRAM**  
**Monday Afternoon**  
2:30–3:45 p.m.

**SESSION A03**  
**Powder Characterization I**  
**Session Chairman:** Christopher T. Adam, Carpenter Technology Corporation

| 121 | USA | 2:30 p.m. | Bridging the Gap Between Ex-Situ Powder Characterization and Performance in a Powder Bed Fusion Process | Justin Whiting, National Institute of Standards and Technology |
| 276 | USA | 2:55 p.m. | Powder Characterization Methods for Additive Manufacturing: Repeatability, Reproducibility and Relevancy | John L. Meyer, Carpenter Technology Corporation |
| **175** | USA | **176** Germany | Nanogalvanic Aluminum Alloys for Hydrogen Generation | Demonstrating a Metal Hydride-Based Energy Storage System for a Residential Home |
| | | | Anit Giri, U.S. Army Research Laboratory | Nils Bornemann, GKN Sinter Metals Engineering GmbH |

**SESSION A04**  
**Stainless Steels**  
**Session Chairman:** Joseph Capone, Ametek, Inc.

| 156 | USA | 2:30 p.m. | Investigation of Corrosion Resistance Behavior of Laser-Powder Bed Fusion Printed 420 Stainless Steel | Sundar V. Atre, University of Louisville |
| 204 | USA | 2:55 p.m. | Investigation of Sintering Variables and Annealing Twin Boundary Microstructure of 316L Stainless Steel Fabricated via Binder-Jet System 3D Printing Using Water-Atomized Powder | Yu Zhou, University of Pittsburgh |
| **199** Portugal | **283** USA | | Optimizing Surface Quality of AISI 420 Stainless Steel Parts Manufactured by Selective Laser Melting | Production of Oxygen on Mars: Flight Qualification of a Solid Oxide Carbide Dioxide Electrolysis Stack |
| | | | Daniel Gatos, University of Coimbra | Salvator Nigarura, Global Tungsten and Powders Corp. |

In the past decade, energy generation and storage have significantly advanced and developed. For example, wind and solar energy generation has gone through major transformation both on technology levels and cost of manufacturing and installations. But the great stumbling block for solar energy, as well as wind power and electric vehicles, has always been storage. Battery technology has gained traction in the last few years for providing more efficient energy storage solutions for renewable energy, portable electronics, electric vehicles, and healthcare. These developments present opportunities and threats to the powder metallurgy industry. The intent of this special interest program is to review new PM solutions for power generation and storage as well as the current state of the art in battery technology. The impact of new battery technology on the growth of electric vehicles and the consequences on PM powertrain components will be explored.

Individual presentation times will run 25 minutes, including questions. Manuscripts that are submitted will be published in the conference proceedings.
### POWDERMET TECHNICAL SESSIONS

#### Monday Afternoon 4:00–5:15 p.m.

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Speaker</th>
<th>Country</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SESSION 09</strong></td>
<td>Refractory Property Improvements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>128 Germany Enhancement of Hardness in Niobium Carbide Composites</td>
<td>Johannes Pötschke,</td>
<td>Germany</td>
<td>4:00 p.m.</td>
</tr>
<tr>
<td></td>
<td>103 Germany Dry Turning with Niobium Carbide Based Tools</td>
<td>Mathias Woydt,</td>
<td>Germany</td>
<td>4:25 p.m.</td>
</tr>
<tr>
<td></td>
<td>170 USA Synthesis and Application of Lanthanum Hexaboride Nanophase Powders for Strengthening Metal and Ceramic Matrices</td>
<td>Arun K. Chattopadhyay,</td>
<td>USA</td>
<td>4:50 p.m.</td>
</tr>
<tr>
<td><strong>SESSION 10</strong></td>
<td>Compaction Improvement</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>135 USA Method to Reduce Die Wear Caused by Abrasive Hard Particle PM Additives</td>
<td>Kylan McQuaig, Hoeganaes Corporation</td>
<td>USA</td>
<td>4:00 p.m.</td>
</tr>
<tr>
<td></td>
<td>118 Italy The Influence of Lubricant on the Constitutive Model of Low-Alloy Steel Powder Mix</td>
<td>Ilaria Cristofolini, University of Trento</td>
<td>Italy</td>
<td>4:25 p.m.</td>
</tr>
<tr>
<td></td>
<td>265 USA Plastic Deformation Investigation of High-Energy Input Friction</td>
<td>Tao Yan, Marquette University</td>
<td>USA</td>
<td>4:50 p.m.</td>
</tr>
<tr>
<td><strong>SESSION 11</strong></td>
<td>Hot Pressing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>064 New Zealand Titanium-Silicon Nitride Fiber Composites Made with Hot-Press and Pressure-Less Sintering</td>
<td>Troy A. Dougherty, Nuenz Limited</td>
<td>New Zealand</td>
<td>4:00 p.m.</td>
</tr>
<tr>
<td></td>
<td>117 Sweden Phase Transformation and Carbide Stability Under Isostatic Pressure in HIP</td>
<td>Irma M. Heikila, Swerea KIMAB AB</td>
<td>Sweden</td>
<td>4:25 p.m.</td>
</tr>
<tr>
<td></td>
<td>250 USA Mechanical Alloying and Consolidation of Mg-Ti Alloys</td>
<td>Laszlo J. Kecskes, MATSYS, Inc.</td>
<td>USA</td>
<td>4:50 p.m.</td>
</tr>
<tr>
<td><strong>SESSION 12</strong></td>
<td>Additive Manufacturing III</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>079 USA Review of Selective Laser Melting Tool Steel Materials and Additive Manufacturing Challenges</td>
<td>Jason W. Goldsmith, Kennametal, Inc.</td>
<td>USA</td>
<td>4:00 p.m.</td>
</tr>
<tr>
<td></td>
<td>089 USA Intelligent Materials Design Methodology to Develop Optimized Alloy Chemistries for Laser Powder Bed Fusion Process and Parts with Superior Mechanical Properties</td>
<td>Sudip Bhattacharya, PMT, Oerlikon Additive Manufacturing</td>
<td>USA</td>
<td>4:25 p.m.</td>
</tr>
<tr>
<td></td>
<td>218 Sweden Hot Cracking of Laser Powder Bed Fusion Processed IN738</td>
<td>Hans Gruber, Chalmers University of Technology</td>
<td>Sweden</td>
<td>4:50 p.m.</td>
</tr>
</tbody>
</table>

**STUDENT POSTER SESSIONS**

Monday Afternoon 4:00–5:15 p.m.
In the past decade, energy generation and storage have significantly advanced and developed. For example, wind and solar energy generation have gone through major transformation both on technology levels and cost of manufacturing and installations. But the great stumbling block for solar energy, as well as wind power and electric vehicles, has always been storage. Battery technology has gained traction in the last few years for providing more efficient energy storage solutions for renewable energy, portable electronics, electric vehicles, and healthcare. These developments present opportunities and threats to the powder metallurgy industry. The intent of this special interest program is to review new PM solutions for power generation and storage as well as the current state of the art in battery technology. The impact of new battery technology on the growth of electric vehicles and the consequences on PM powertrain components will be explored.

### Special Interest Program

**Session A05**

**Powder Characterization II**

**Session Chairman:**

Art Kracke, AAK Consulting, LLC.

<table>
<thead>
<tr>
<th>Time</th>
<th>Country</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>4:00</td>
<td>USA</td>
<td>Extending the Range of EVs Cost Effectively: A PM Industry Challenge and Opportunity (LIFT)</td>
</tr>
<tr>
<td>4:25</td>
<td>USA</td>
<td>The Importance of Powders and Powder Processing on Battery Performance</td>
</tr>
<tr>
<td>4:50</td>
<td>USA</td>
<td>Molybdenum in Photovoltaic Technology</td>
</tr>
</tbody>
</table>

### AMPM Technical Sessions

**Session A06**

**Magnetic Materials**

**Session Chairman:**

Robert M. Gasior, Arconic Technology Center

<table>
<thead>
<tr>
<th>Time</th>
<th>Country</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>4:00</td>
<td>USA</td>
<td>Laser Additive Manufacturing of Magnetic Materials</td>
</tr>
<tr>
<td>4:25</td>
<td>USA</td>
<td>Cold Spray Additive Manufacturing of Rare-Earth Permanent Magnets</td>
</tr>
</tbody>
</table>

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In the past decade, energy generation and storage have significantly advanced and developed. For example, wind and solar energy generation have gone through major transformation both on technology levels and cost of manufacturing and installations. But the great stumbling block for solar energy, as well as wind power and electric vehicles, has always been storage. Battery technology has gained traction in the last few years for providing more efficient energy storage solutions for renewable energy, portable electronics, electric vehicles, and healthcare. These developments present opportunities and threats to the powder metallurgy industry. The intent of this special interest program is to review new PM solutions for power generation and storage as well as the current state of the art in battery technology. The impact of new battery technology on the growth of electric vehicles and the consequences on PM powertrain components will be explored.

Individual presentation times will run 25 minutes, including questions. Manuscripts that are submitted will be published in the conference proceedings.
### POWDERMET TECHNICAL SESSIONS

**Tuesday Morning**

<table>
<thead>
<tr>
<th>Session</th>
<th>USA</th>
<th>8:00 a.m.</th>
<th>Presentation Title</th>
<th>Time</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>078</td>
<td></td>
<td>8:00 a.m.</td>
<td>Effect of Carbon and Nitrogen Impurities on Aging of Sintered Soft Magnetic Materials</td>
<td>8:25 a.m.</td>
<td>Belgium</td>
</tr>
<tr>
<td>169</td>
<td></td>
<td>8:00 a.m.</td>
<td>Total Control of Powder Metal Sintering Process for Complete Optimization of Atmosphere and Its Thermodynamics</td>
<td>8:50 a.m.</td>
<td>USA</td>
</tr>
<tr>
<td>227</td>
<td></td>
<td>8:00 a.m.</td>
<td>The Effect of Sintering Conditions on the Mechanical Properties of Prealloyed Vanadium Powder Metallurgy Steels</td>
<td>8:50 a.m.</td>
<td>USA</td>
</tr>
<tr>
<td>260</td>
<td></td>
<td>8:00 a.m.</td>
<td>A Comparative Study of the Properties of Metal Injection Molded Low-Alloy Steels</td>
<td>8:50 a.m.</td>
<td>USA</td>
</tr>
<tr>
<td>268</td>
<td></td>
<td>8:25 a.m.</td>
<td>Hot Zone Nitrogen-Hydrogen Atmosphere Monitoring with Gas Density Sensor</td>
<td>8:50 a.m.</td>
<td>USA</td>
</tr>
<tr>
<td>270</td>
<td></td>
<td>8:25 a.m.</td>
<td>Standardization of Sintering Furnaces for Increased Furnace Optimization and Throughput</td>
<td>8:50 a.m.</td>
<td>USA</td>
</tr>
<tr>
<td>098</td>
<td></td>
<td>8:25 a.m.</td>
<td>Investigation of Sintering of Different Tool Steels Made by MIM</td>
<td>8:50 a.m.</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>088</td>
<td></td>
<td>8:25 a.m.</td>
<td>The Effect of Pore Size and Grain Size on the High-Cycle Fatigue Behavior of Injection Molded Ti-6Al-4V Alloys</td>
<td>8:50 a.m.</td>
<td>Japan</td>
</tr>
</tbody>
</table>

**Session Chairmen:**
- **Process Optimization**
  - Timothy E. Geiman, Keystone Powdered Metal Company
- **Sintering Atmosphere Control**
  - Mark Saline, Gasbarre Furnace Group
- **PM Low-Alloy Steels**
  - Arthur E. Jones, Symmco, Inc.
- **MIM I: Materials**
  - Lane Donoho, Advanced Metalworking Practices, LLC

**No presentation scheduled at this time.**

### STUDENT POSTER SESSIONS

**Tuesday Morning**

<table>
<thead>
<tr>
<th>USA</th>
<th>8:00–9:15 a.m.</th>
<th>Presentation Title</th>
<th>Time</th>
<th>Location</th>
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<tbody>
<tr>
<td>8:00 a.m.</td>
<td>Effect of Carbon and Nitrogen Impurities on Aging of Sintered Soft Magnetic Materials</td>
<td>8:25 a.m.</td>
<td>Belgium</td>
<td></td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>Measuring Electrostatic Properties of Metallic Powders with Granucharge Instrument</td>
<td>8:50 a.m.</td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>No presentation scheduled at this time.</td>
<td>8:50 a.m.</td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>Total Control of Powder Metal Sintering Process for Complete Optimization of Atmosphere and Its Thermodynamics</td>
<td>8:50 a.m.</td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>Hot Zone Nitrogen-Hydrogen Atmosphere Monitoring with Gas Density Sensor</td>
<td>8:50 a.m.</td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>Standardization of Sintering Furnaces for Increased Furnace Optimization and Throughput</td>
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<td>USA</td>
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</tr>
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<td>8:00 a.m.</td>
<td>Investigation of Sintering of Different Tool Steels Made by MIM</td>
<td>8:50 a.m.</td>
<td>United Kingdom</td>
<td></td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>The Effect of Pore Size and Grain Size on the High-Cycle Fatigue Behavior of Injection Molded Ti-6Al-4V Alloys</td>
<td>8:50 a.m.</td>
<td>Japan</td>
<td></td>
</tr>
</tbody>
</table>
This program will examine topics of current interest to the refractory metals and manufacturing community and others with interest in these processes and related materials. In these sessions we will present the latest information on the health, safety, and regulatory environment surrounding the use of tungsten carbides and, in particular, cobalt. Presentations will be provided that examine the replacement of cobalt in the WC cermet system and provide cobalt-free options for this material. Further we will examine the emerging technology of additive manufacturing with particular emphasis on refractory metals in this manufacturing environment.

Individual presentation times will run 25 minutes, including questions. Manuscripts that are submitted will be published in the conference proceedings.

**SESSION A07**

**Process Parameters and Structure/Property Relationships I**

**Session Chairman:**
Juha Kotila,
EOS Finland

259 USA 8:00 a.m. Microstructure and Solidification Conditions in Metal Additive Manufacturing Using a Multi-Beam Laser Energy Source
A. Plotkowski,
Oak Ridge National Laboratory

123 Finland 8:25 a.m. Relating Process to Structure in Selective Laser Melting of Ti-6Al-4V via Phase Field Modeling
Tatu Pinomaa,
VTT Technical Research Centre of Finland

148 Malaysia 8:50 a.m. Microstructure and Mechanical Behavior of CoCr Biomedical Alloy Fabricated by Selective Laser Melting and Hot Isostatic Pressing
Kim S. Tan,
Oryx Advanced Materials Sdn. Bhd

045 Russia 9:15 a.m. Nitinol Microstructure Characterization After Layerwise Laser and Electron Beam Melting
Igor Shishkovsky,
Lebedev Physics Institute (LPI) of Russian Academy of Sciences (RAS), Samara branch

**SESSION A08**

**Nickel-Based Alloys**

**Session Chairman:**
Andrzej L. Wojciezynski,
ATI Powder Metals

057 USA 8:00 a.m. A Study of the Elevated Tensile Properties of Additive Manufactured Nickel-Based Super Alloys
Andrew Carter,
Stratasys Direct Manufacturing

150 USA 8:25 a.m. Evaluation Metrics for Alloy Design in Feedstock Powder for Additive Manufacturing
Tim Prost,
Ames Laboratory (USDOE)

077 USA 8:50 a.m. Microstructure Characterization of Haynes-282 Alloy Fabricated Using Laser Powder Bed Fusion Process
Anagh T. Deshpande,
University of Louisville

116 Finland 9:15 a.m. Characterization of Hard-to-Weld Nickel-Based Superalloys in Additive Manufacturing
Kristiina Kupi,
EOS Finland Oy

**SESSION A09**

**Design Consideration I**

**Session Chairman:**
Ashley Nichols,
3D Materials Technologies, LLC

160 USA 8:00 a.m. Design and Evaluation of L-PBF Printed Mold with Conformal Cooling Channel
Sundar V. Atre,
University of Louisville

033 United Kingdom 8:25 a.m. Embedding Functional Topographies into the Surfaces of Additively Manufactured Structures
Joe B. Howard,
University of Surrey & Rolls-Royce plc.

036 Switzerland 8:50 a.m. Selective Laser Melting of Niobium for Superconducting Application
Romain L. Gerard,
CERN

143 USA 9:15 a.m. Increased Metal Additive Success Utilizing Build Simulation Software
Ryan Kircher,
3D Systems
### POWDERMET TECHNICAL SESSIONS

**Tuesday Morning**  
10:30–11:45 a.m.

<table>
<thead>
<tr>
<th>SESSION 17</th>
<th>Process Monitoring</th>
<th>Session Chairman: Joseph C. Davis, FMS Corporation</th>
</tr>
</thead>
<tbody>
<tr>
<td>264</td>
<td>USA</td>
<td>10:30 a.m. Acoustic Monitoring for Additive Manufacturing Process and Material Condition Determination Lucas W. Koester, Iowa State University—Center for Nondestructive Evaluation (CNDE)</td>
</tr>
<tr>
<td>066</td>
<td>Canada</td>
<td>10:55 a.m. High-Speed Infrared Imaging of Metal Parts Fabrication by Additive Manufacturing Marc-Antoine Langevin, Telops</td>
</tr>
<tr>
<td>055</td>
<td>Canada</td>
<td>11:20 a.m. Porosity Evaluation of Compacted and Sintered Parts Using X-Ray Tomography Morgan Letenneur, École de Technologie Supérieure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SESSION 18</th>
<th>Sintering Processes</th>
<th>Session Chairman: Dustin Yetzer, Abbott Furnace Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>213</td>
<td>USA</td>
<td>10:30 a.m. Improvements in Form Error of Large PM Parts Made From Production Tooling, Comparing New Technologies to Historical Production Methods and Materials Arthur E. Jones, Symmco, Inc.</td>
</tr>
<tr>
<td>252</td>
<td>USA</td>
<td>10:55 a.m. Crack Initiation and Growth in Constrained Sintering Reid Carazzone, Rice University</td>
</tr>
<tr>
<td>069</td>
<td>USA</td>
<td>11:20 a.m. Temperature, Geometry, and Particle-Size Effects on Slumping in Overhanging Features Zachary C. Cordero, Rice University</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SESSION 19</th>
<th>Atomization</th>
<th>Session Chairman: John Meyer, Carpenter Technology Corporation</th>
</tr>
</thead>
<tbody>
<tr>
<td>021</td>
<td>Canada</td>
<td>10:30 a.m. Review of the Past, Present and Future of Plasma Atomization Christopher A. Dion, PyroGenesis Additive</td>
</tr>
<tr>
<td>155</td>
<td>USA</td>
<td>10:55 a.m. Investigation of the Effect of Binary Gas Mixtures on Close-Coupled Gas Atomization with Open Wake Gas Flow Jordan A. Tiarks, Ames Laboratory (USDOE)</td>
</tr>
<tr>
<td>126</td>
<td>Canada</td>
<td>11:20 a.m. Experimental and Computational Analysis of a Water Spray; Application to Molten Metal Atomization Ali Asgarian, University of Toronto</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SESSION 20</th>
<th>MIM II: Molding</th>
<th>Session Chairman: S. K. Tam, Ormco</th>
</tr>
</thead>
<tbody>
<tr>
<td>149</td>
<td>USA</td>
<td>10:30 a.m. Influence of Feedstock Property Estimates on Powder Injection Molding Simulations and Experiments of PZT Micro-Pillar Arrays Kunal Kate, University of Louisville</td>
</tr>
<tr>
<td>125</td>
<td>Canada</td>
<td>10:55 a.m. Molding Properties of Cobalt-Based Feedstocks Used in Low-Pressure Powder Injection Molding Ehsan Gholami, École de Technologie Supérieure</td>
</tr>
<tr>
<td>279</td>
<td>United Kingdom</td>
<td>11:20 a.m. Effect of Particle-Size Distribution and Powder Loading on Processing and Properties of MIM 17-4PH Martin A. Kears, Sandvik Osprey Limited</td>
</tr>
</tbody>
</table>

### STUDENT POSTER SESSIONS

**Tuesday Morning**  
10:30–11:45 a.m.
**SPECIAL INTEREST PROGRAM**  
Tuesday Morning  10:30–11:45 a.m.

### SIP 3—PART 2

**Tungsten & Refractory Metals: Cobalt-Free Refractory Metals—II**

- **Program Organizers:** Robert J. Dowding, U.S. Army Research Laboratory, Michael T. Stawowy, H. C. Starck, Inc.

This program will examine topics of current interest to the refractory metals and manufacturing community and others with interest in these processes and related materials. In these sessions we will present the latest information on the health, safety, and regulatory environment surrounding the use of tungsten carbides and, in particular, cobalt. Presentations will be provided that examine the replacement of cobalt in the WC cermet system and provide cobalt-free options for this material. Further we will examine the emerging technology of additive manufacturing with particular emphasis on refractory metals in this manufacturing environment.

Individual presentation times will run 25 minutes, including questions. Manuscripts that are submitted will be published in the conference proceedings.

**Session Chairman:**
Michael T. Stawowy, H. C. Starck, Inc.

<table>
<thead>
<tr>
<th>Session</th>
<th>USA</th>
<th>10:30 a.m.</th>
<th>USA</th>
<th>10:55 a.m.</th>
<th>USA</th>
<th>11:20 a.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>141</td>
<td>Powder Attributes in Laser Powder Bed Fusion of 420 Stainless Steel</td>
<td>Sundar V. Atre, University of Louisville</td>
<td>090</td>
<td>All Powders Are Not Created Equal: A Study in Ti-6Al-4V</td>
<td>Ajay V. Krishnan, Incodema3D, LLC</td>
<td>058</td>
</tr>
<tr>
<td>254</td>
<td>Predicting Extrusion 3D Printing Feed Rate Using Viscosity-Shear Rate Measurements for Ceramic Polymer-Filled Feedstocks</td>
<td>Kunal Kate, University of Louisville</td>
<td>019</td>
<td>Bound Metal Deposition (BMD): A Versatile Metal Additive Manufacturing Technology</td>
<td>Animesh Bose, FAPMI, Desktop Metal</td>
<td>251</td>
</tr>
</tbody>
</table>

**AMPM TECHNICAL SESSIONS**  
Tuesday Morning  10:30–11:45 a.m.

### SESSION A10

**Powder Characterization III**

- **Session Chairman:** Rajendra Kelkar, PMT, GE Additive

<table>
<thead>
<tr>
<th>Session</th>
<th>USA</th>
<th>10:30 a.m.</th>
<th>USA</th>
<th>10:55 a.m.</th>
<th>USA</th>
<th>11:20 a.m.</th>
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</thead>
</table>

### SESSION A11

**Powder and Powder Production**

- **Session Chairman:** Thomas W. Pelletiers, Kymera International

<table>
<thead>
<tr>
<th>Session</th>
<th>USA</th>
<th>10:30 a.m.</th>
<th>USA</th>
<th>10:55 a.m.</th>
<th>USA</th>
<th>11:20 a.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>019</td>
<td>USA</td>
<td>Bound Metal Deposition (BMD): A Versatile Metal Additive Manufacturing Technology</td>
<td>Animesh Bose, FAPMI, Desktop Metal</td>
<td>058</td>
<td>Brazil</td>
<td>Rheology Study for Plasma Atomized, HDH and HDH + Spheroidized Ti Alloy Powders</td>
</tr>
</tbody>
</table>

### SESSION A12

**Fused Deposition Modeling**

- **Session Chairman:** Todd Palmer, Pennsylvania State University

<table>
<thead>
<tr>
<th>Session</th>
<th>USA</th>
<th>10:30 a.m.</th>
<th>USA</th>
<th>10:55 a.m.</th>
<th>USA</th>
<th>11:20 a.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>254</td>
<td>USA</td>
<td>Predicting Extrusion 3D Printing Feed Rate Using Viscosity-Shear Rate Measurements for Ceramic Polymer-Filled Feedstocks</td>
<td>Kunal Kate, University of Louisville</td>
<td>019</td>
<td>USA</td>
<td>Bound Metal Deposition (BMD): A Versatile Metal Additive Manufacturing Technology</td>
</tr>
</tbody>
</table>
Tuesday Afternoon, June 19
2:15–3:00 p.m.

The Center for Powder Metallurgy Technology (CPMT) merges the academic and corporate PM worlds together with a joint goal to promote PM industry progress. Through collaboration, the transfer of knowledge and technological advancement is utilized to advance the growth of the PM industry.

This oral presentation only session will share recent R&D activities completed by CPMT. *(No printed manuscript)*

**Session Chairman:**
Arthur E. (Bud) Jones, CPMT President, Symmco, Inc.

**Powder Metallurgical Study: Single Tooth Bending Fatigue**
John Engquist, FAPMI, JENS Solutions, Inc., on behalf of CPMT

CPMT conducted a program to determine the single tooth bending fatigue (STBF) endurance limits and single cycle tooth overload limits for a wide variety of popular powder metal materials and processes. A wide variety of PM alloys and numerous PM processing techniques were investigated. Results show that PM materials and processes can favorably compare and exceed single cycle bending fatigue performance exhibited by heat treated wrought and cast iron gears.

**Shot Peen for Improved Gear Performance**
Chad Spore, John Deere on behalf of CPMT

CPMT investigated the effects of shot peening (normal and micro peening) on the gear performance of a high density PM planetary gear used in a hand held power tool. The presentation will review the effects of shot peening on residual stress, microstructure, density, dimensions and surface finish, as well as gear test performance.

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**PM TECHNOLOGY SCAN—2018**

Tuesday Afternoon, June 19
3:30–4:00 p.m.

*This presentation will focus upon recent technology developments, opportunities, perceived threats, challenges, and barriers to growth uncovered during the most recent Technology Assessment investigation performed by MPIF Technical Board members. *(No printed manuscript)*

**MACHINERY SENSORS & INFORMATION TECHNOLOGY**
The ability to control processes is directly related to monitoring the variables driving the process. In PM, temperature, velocity, flow, position, pressure, and force are all examples of data critical to the quality of product produced. Developments in sensors monitoring and controlling various processes in the PM industry are explored defining current state-of-the-art, emerging new technology, and the architecture used to deliver this data to enterprise wide information systems. Combining the data can enable real time decisions improving quality, efficiency, accuracy and delivery.

**SESSION CHAIRMAN:**
Thomas W. Pelletiers, Kymera International

**SPEAKER:**
Blaine A. Stebick, Phoenix Sintered Metals, LLC

**Investigators:**
William R. Gasbarre, FAPMI, Gasbarre Products, Inc.  
Daniel P. Reardon, Abbott Furnace Company  
Thomas W. Pelletiers, Kymera International  
Blaine A. Stebick, Phoenix Sintered Metals, LLC

*(Open only to qualified MPIF-member registrants.)*
### SPECIAL INTEREST PROGRAM

**Tuesday Afternoon  2:15–3:30 p.m.**

<table>
<thead>
<tr>
<th>Program Title</th>
<th>USA</th>
<th>Time</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SIP 3—PART 3</strong> Tungsten &amp; Refractory Metals: Additive Manufacturing of Refractory Metals</td>
<td></td>
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</tr>
<tr>
<td><strong>Program Organizers:</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Robert J. Dowding, U.S. Army Research Laboratory</td>
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<tr>
<td>Michael T. Stawowy, H. C. Starck, Inc.</td>
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<tr>
<td><strong>Session Chairman:</strong></td>
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</tr>
<tr>
<td>Robert J. Dowding, U.S. Army Research Laboratory</td>
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<td></td>
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</tr>
<tr>
<td>Ravi K. Enneti, Global Tungsten &amp; Powders Corporation</td>
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</tr>
<tr>
<td>Michael T. Stawowy, H. C. Starck, Inc.</td>
<td></td>
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</table>

This program will examine topics of current interest to the refractory metals and manufacturing community and others with interest in these processes and related materials. In these sessions we will present the latest information on the health, safety, and regulatory environment surrounding the use of tungsten carbides and, in particular, cobalt. Presentations will be provided that examine the replacement of cobalt in the WC cermet system and provide cobalt-free options for this material. Further we will examine the emerging technology of additive manufacturing with particular emphasis on refractory metals in this manufacturing environment.

Individual presentation times will run 25 minutes, including questions. Manuscripts that are submitted will be published in the conference proceedings.

### AMPM TECHNICAL SESSIONS

**Tuesday Afternoon  2:15–3:55 p.m.**

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>USA</th>
<th>Time</th>
<th>Speaker(s)</th>
</tr>
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<tbody>
<tr>
<td><strong>SESSION A13</strong> Process Parameters and Structure/Property Relationships II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>243</td>
<td>Optimized Parameters for Selective Laser Melting of 4340 Steel</td>
<td></td>
<td>2:15 p.m.</td>
<td>Trevor W. Verdronik, Lehigh University</td>
</tr>
<tr>
<td>172</td>
<td>Developing a Process for Establishing Parameters for Laser Powder Bed Fusion—It Is Not So Hard!</td>
<td></td>
<td>2:40 p.m.</td>
<td>James W. Sears, Carpenter Technology Corporation</td>
</tr>
<tr>
<td>200</td>
<td>Assessment of the Spatial Variation in Powder Bed Content Due to Recoating and Spatter Generation in Laser Powder Bed Fusion</td>
<td></td>
<td>3:05 p.m.</td>
<td>Alexander N. Gasp, University of Nottingham</td>
</tr>
<tr>
<td>185</td>
<td>Laser Metal Deposition for Aerospace Prototyping</td>
<td></td>
<td>2:15 p.m.</td>
<td>Melanie A. Lang, Formalloy Additive Manufacturing Technologies</td>
</tr>
<tr>
<td>037</td>
<td>Advancing Metal Additive Manufacturing Materials and Processes</td>
<td></td>
<td>2:40 p.m.</td>
<td>Richard Grylls, SLM Solutions NA</td>
</tr>
<tr>
<td>214</td>
<td>Metal Additive Manufacturing—Practical Applications</td>
<td></td>
<td>3:05 p.m.</td>
<td>Dan Skulan, Renishaw, Inc.</td>
</tr>
</tbody>
</table>

**SESSION A14** Composites and Bi-Metallics

**Session Chairman:** Rajiv Tandon, Luxfer Magtech

| 198 | Metal Matrix Nanocomposite Powders for Metal Additive Manufacturing | | 2:15 p.m. | Lianyi Chen, Missouri University of Science and Technology |
| 081 | 3D Printing with Carbon Powders | | 2:40 p.m. | Erica L. Hillebrand, SGL Group |
| 215 | Additive Manufacturing of Bimetallic Structures Using Laser Engineered Net Shaping | | 3:05 p.m. | Bonny Onuikje, Washington State University |

**SESSION A15** Design Considerations II

**Session Chairman:** Aaron LaLonde, BeAM Machines, Inc.

| 185 | Laser Metal Deposition for Aerospace Prototyping | | 2:15 p.m. | Melanie A. Lang, Formalloy Additive Manufacturing Technologies |
| 037 | Advancing Metal Additive Manufacturing Materials and Processes | | 2:40 p.m. | Richard Grylls, SLM Solutions NA |
| 214 | Metal Additive Manufacturing—Practical Applications | | 3:05 p.m. | Dan Skulan, Renishaw, Inc. |
| 073 | 3D Post-Printing and the Direct Relationship to the Advancement of the Direct Digital Thread (DDT) for Direct Digital Metal Additive Manufacturing | | 3:30 p.m. | Daniel Hutchinson, PostProcess Technologies |
### POWDERMET TECHNICAL SESSIONS

#### SESSION 21
**Novel Materials**
- **Session Chairman:** Leonid I Frayman, Allegheny Coatings

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Time</th>
<th>Location</th>
<th>Title &amp; Details</th>
</tr>
</thead>
</table>
| 253 Brazil   | 4:40 p.m. | Brazil | Influence of SiC Addition and on the Fracture Toughness and Crack Propagation Rate of Injection Molded Self-Lubricating Sintered Steels  
Gustavo R. Paz, Sr., LabMat/Universidade Federal de Santa Catarina |

#### SESSION 22
**Surface Modification & Characterization**
- **Session Chairman:** Arun Chattopadhyay, Etmine USA, Inc.

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Time</th>
<th>Location</th>
<th>Title &amp; Details</th>
</tr>
</thead>
</table>
| 275 USA      | 4:15 p.m. | USA | Progress Toward Increased Powder Quality for Additive Manufacturing by Gas Atomization  
Iver E. Anderson, FAPMI, Ames Laboratory (USDOE) |
| 097 USA      | 4:40 p.m. | USA | Understanding Surface Area Measurement Techniques for Improved Powder Production  
Jack G. Saad, Micromeritics Instrument Corporation |
| 222 USA      | 4:40 p.m. | USA | In-Situ Gas-Phase Passivation of Molten Calcium Surfaces to Enable Development of Atomization Method for Generating Calcium Powder  
Charles F. Czahor, Iowa State University |

#### SESSION 23
**High-Complexity & High-Density Forming**
- **Session Chairman:** John W. von Arx, NetShape Technologies, Inc.

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Time</th>
<th>Location</th>
<th>Title &amp; Details</th>
</tr>
</thead>
</table>
| 246 Switzerland | 4:15 p.m. | Switzerland | Recent Innovations on Cold Axial Die Compaction Technologies  
Guiellermo Polo, Osterwalder AG |
| 249 USA      | 4:40 p.m. | USA | Ultrasonic Compaction of Nanostructured Copper Powder  
Christopher A. Hareland, Rice University |
| 167 USA      | 4:40 p.m. | USA | Methods of Achieving Higher Density in Powder Metal Parts by Single Press and Single Sinter-Critical Review  
Kalathur S. Narasimhan, FAPMI, P2P Technologies |

### STUDENT POSTER SESSIONS

- **Tuesday Afternoon, 4:15–5:30 p.m.**
This program will examine topics of current interest to the refractory metals and manufacturing community and others with interest in these processes and related materials. In these sessions we will present the latest information on the health, safety, and regulatory environment surrounding the use of tungsten carbides and, in particular, cobalt. Presentations will be provided that examine the replacement of cobalt in the WC cermet system and provide cobalt-free options for this material. Further we will examine the emerging technology of additive manufacturing with particular emphasis on refractory metals in this manufacturing environment.

Individual presentation times will run 25 minutes, including questions. Manuscripts that are submitted will be published in the conference proceedings.
### POWDERMET TECHNICAL SESSIONS

**Wednesday Morning 8:00–9:15 a.m.**

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Country</th>
<th>Time</th>
<th>Title</th>
<th>Country</th>
<th>Time</th>
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<tr>
<td><strong>SESSION 24</strong></td>
<td><strong>Powder Characterization</strong></td>
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<tr>
<td></td>
<td>Online Particle-Size Characterization: Feedback for Real-Time Metal Atomization Process Optimization and Control</td>
<td>USA</td>
<td>8:00 a.m.</td>
<td>An Experimental Study on the Powders’ Sizes and Hardenability</td>
<td>Canada</td>
<td>8:25 a.m.</td>
<td>Review of Parameters Influencing the Compressibility of Fe-Based Powders</td>
</tr>
<tr>
<td></td>
<td>Factors Influencing Microstructural Evolution in Cemented Carbide</td>
<td>USA</td>
<td>8:00 a.m.</td>
<td>Modeling Heat Transfer and Reaction Energy of Tungsten Carburization in a Pusher Furnace</td>
<td>USA</td>
<td>8:25 a.m.</td>
<td>Powder Injection Molding of Tungsten Nanopowder</td>
</tr>
<tr>
<td></td>
<td>Inertia Rotary Friction Welding of New Generation PM Aluminum Alloys</td>
<td>USA</td>
<td>8:00 a.m.</td>
<td>Study on Microstructure, Mechanical Characteristics and Corrosion Performance of Artifacts Processed by Post-Sinter Hybrid Porosity Sealing and Subsequent Heat Treatment</td>
<td>USA</td>
<td>8:25 a.m.</td>
<td>Industrial Gas Supply Systems for the Additive Manufacturing Industry</td>
</tr>
</tbody>
</table>

### STUDENT POSTER SESSIONS

**Wednesday Morning 8:00–9:15 a.m.**
# Machinability: New Considerations for PM Machining

**Program Organizers:**
Carl Blais, Laval University  
Denis Christopherson, PMT, Federal-Mogul Sintered Products

**Session Chairman:**
Carl Blais, Laval University

Machining of powder metallurgy materials is a critical practice for most PM applications, often defining fit, form, function, and financial success. The process of machining PM materials is arguably more complex than cast and wrought materials, and tools and techniques used for the latter are not optimized for the former. This Special Interest Program will offer perspective toward typical PM machining challenges and methods to measure, analyze, and improve the machining process. Within the program, focused presentations include PM material advances, tool technology, machining process characterization and case studies, providing a wide scope of ideas and concepts useful to anyone involved in PM machining.

Individual presentation times will run 25 minutes, including questions. Manuscripts that are submitted will be published in the conference proceedings.

**SIP 4—PART 1**  
**Machinability: New Considerations for PM Machining**

<table>
<thead>
<tr>
<th>Session Title</th>
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<th>Time</th>
<th>Presenter(s)</th>
<th>Institution(s)</th>
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<tbody>
<tr>
<td>Introduction of Minimum Quantity Lubrication (MQL) for PM Reaming</td>
<td>183</td>
<td>8:00 a.m.</td>
<td>Denis Christopherson, PMT, Federal-Mogul Sintered Products</td>
<td></td>
</tr>
<tr>
<td>Machining Solutions for PM Materials – Linking Principles to PM Applications</td>
<td>124</td>
<td>8:25 a.m.</td>
<td>Bo Hu, North American Höganäs, Inc.</td>
<td></td>
</tr>
<tr>
<td>Humidity and Temperature: A Study on the Stability of MnS and Effect on Machining</td>
<td>191</td>
<td>8:50 a.m.</td>
<td>Neal P. Kraus, Hoeganaes Corporation</td>
<td></td>
</tr>
</tbody>
</table>

**SESSION A19**  
**Process and Product Analytics I**

**Session Chairman:**
John D. Hunter, LPW Technology, Inc.

- **266 USA** Benefits of In-Situ Particle-Size Analysis in a Gas-Atomization System  
  David J. Byrd, Ames Laboratory

- **087 USA** High-Throughput Quality Control on Metal Powder and Parts Produced with Additive Manufacturing Technologies  
  Kristin Mulherin, Thermo Fisher Scientific

- **153 USA** Tracking the Evolution of Phase and Microstructure Using High Speed In-Situ X-Ray Diffraction of Metallic Alloys During Selective Laser Melting Additive Manufacturing  
  Vivek Thampy, SSRL, SLAC National Accelerator Laboratory

**SESSION A20**  
**Aluminum Alloys II**

**Session Chairman:**
Sudarsanam S. Babu, University of Tennessee College of Engineering

- **010 Israel** Strain Rate Sensitivity and Fracture Mechanism of AlSi10Mg Fabricated by AM-SLM  
  Idan Rosenthal, Ben Gurion University of the Negev

- **152 USA** In-Situ Synchrotron Measurements of Deformation Behavior in Additively Manufactured Al-Ce Alloys  
  Ryan T. Ott, Ames Laboratory (USDOE)

- **088 Singapore** Effect of Layers on the Microstructure of AlSi10Mg Processed by Selective Laser Melting  
  Liap Tat Su, Singapore Polytechnic

**SESSION A21**  
**Post Processing of AM Builds and Powder I**

**Session Chairman:**
Kester Clarke, Colorado School of Mines

- **070 USA** Cost Effective Hot Isostatic Pressing: A Cost Calculation Study for AM Parts  
  Magnus Ahlfors, Quintus Technologies, LLC

- **163 USA** Effect of Hot Isostatic Pressing on the Mechanical Properties and Microstructures of 17-4 PH Stainless Steel Fabricated Using Laser Powder Bed Fusion  
  Sundar Atre, University of Louisville

- **280 Finland** Development of Post-AM Heat Treatment for IN939 Produced by Direct Metal Laser Sintering  
  Abdul Shaafi Shaikh, EOS Finland Oy
### POWDERMET TECHNICAL SESSIONS

**Wednesday Morning**
9:30–10:45 a.m.

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Location</th>
<th>Time</th>
<th>Speaker(s)</th>
</tr>
</thead>
</table>
| **SESSION 27** | Sinter Hardening Session Chairman: Jeffrey A. Danaher, Abbott Furnace Company | USA      | 9:30 a.m. | 286 USA  
Sinter Hardening Response of a Lean Sinter Hardening Alloy  
Suresh O. Shah, AAM—Powertrain  
179 Canada  
An Experimental Study on the Influence of Porosity on Hardenability  
Paul G. Tallon, McMaster University and Stackpole International  
219 India  
Sinter Hardening Furnace Design for Normal and Hardened PM Parts  
Ravi P. Malhotra, Malhotra Engineers |
| **SESSION 28** | Mechanical Properties Session Chairman: Edmond Ilia, AAM—Powertrain | USA      | 9:30 a.m. | 237 USA  
Fatigue of Powder Metallurgy Materials  
Ian W. Donaldson, FAPMI, GKN Sinter Metals, LLC  
122 USA  
The Influence of Tempering Parameters on the Microstructure and Mechanical Properties of Sintered Low-Alloy Steels  
Amber Neilan, PMT, North American Höganäs, Inc.  
208 USA  
Tying Processing Parameter to the Microstructure and Mechanical Properties of Nano-Grained FeNiZr Consolidated via the Field Assisted Sintering Technique  
Sean Fudger, U.S. Army Research Laboratory |
| **SESSION 29** | Lightweight PM Materials Session Chairman: Blaine Stebick, Phoenix Sintered Metals LLC | USA      | 9:30 a.m. | 284 USA  
Introduction of Aluminum PM Grade with Low Shrinkage and Excellent Wear Properties  
Jessu Joys, United States Metal Powders, Inc.  
083 USA  
Comparison of Consolidation Processes of Mechanically Alloyed Al-Sic Metal Matrix Composite Powders  
Kyung H. Chung, Materion Beryllium and Composites  
192 USA  
The Manufacture, Thermo-Mechanical Processing and Characterization of Ceramic Particulate Reinforced Magnesium Powder-Metallurgy Based Metal-Matrix-Composites  
Cory Smith, DWA Aluminum Composites USA, Inc. |

### STUDENT POSTER SESSIONS

**Wednesday Morning**
9:30–10:45 a.m.
**SIP 4—PART 2**

### Machinability: Machining Alternatives for PM Materials

**Program Organizers:**
- Carl Blais, Laval University
- Denis Christopherson, PMT, Federal-Mogul Sintered Products

**Session Chairman:**
Denis Christopherson, Federal-Mogul Sintered Products

- **189 USA**
  - *Modern Tools and Techniques for Machining PM Materials*
  - Don E. Graham, Seco Tools

- **221 USA**
  - *A Systematic Approach to Successfully Machining Powdered Metals Based on Both Theoretical and Empirical Data*
  - Gary T. McCarel, Star Cutter Company

- **210 USA**
  - *Super Abrasive Grinding—A Cost Effective Means to Finish Hardened Parts*
  - Matthew Brown, Advanced Automotive Grinding

Machining of powder metallurgy materials is a critical practice for most PM applications, often defining fit, form, function, and financial success. The process of machining PM materials is arguably more complex than cast and wrought materials, and tools and techniques used for the latter are not optimized for the former. This Special Interest Program will offer perspective toward typical PM machining challenges and methods to measure, analyze, and improve the machining process. Within the program, focused presentations include PM material advances, tool technology, machining process characterization and case studies, providing a wide scope of ideas and concepts useful to anyone involved in PM machining.

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**AMPM TECHNICAL SESSIONS**

### SESSION A22

**Process and Product Analytics II**

**Session Chairman:**
Mike Gibson, Desktop Metal

<table>
<thead>
<tr>
<th>Session</th>
<th>Country</th>
<th>Time</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>282 USA</td>
<td><strong>9:30 a.m.</strong></td>
<td>Using Light and Electron Microscopy in Conjunction with Computed Tomography to Evaluate Additive Manufacturing Powders and Parts</td>
<td>Thomas F. Murphy, FAPMI, Hoeganaes Corporation</td>
<td></td>
</tr>
<tr>
<td>075 USA</td>
<td><strong>9:55 a.m.</strong></td>
<td>Monitoring-Based Process Evaluation and Quality Control in AM</td>
<td>Anja V. Loesser, EOS North America</td>
<td></td>
</tr>
</tbody>
</table>

### SESSION A23

**Aluminum Alloys III**

**Session Chairman:**
Andrew Carter, Stratasys Direct Mfg.

<table>
<thead>
<tr>
<th>Session</th>
<th>Country</th>
<th>Time</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 Finland</td>
<td><strong>9:30 a.m.</strong></td>
<td>Heat Treatment of Additionally Manufactured Aluminium Alloys</td>
<td>Jukka J. Simola, EOS Finland Oy</td>
<td></td>
</tr>
<tr>
<td>164 USA</td>
<td><strong>9:55 a.m.</strong></td>
<td>Processing of High-Strength Aluminum Materials Through DMLS</td>
<td>Ankit Saharan, EOS</td>
<td></td>
</tr>
<tr>
<td>109 Finland</td>
<td><strong>10:20 a.m.</strong></td>
<td>Lightweight Alloys by Additive Manufacturing</td>
<td>Juha Kotila, EOS Finland</td>
<td></td>
</tr>
</tbody>
</table>

### SESSION A24

**Post Processing of AM Builds and Powder II**

**Session Chairman:**
Matt Devine, PMT, North American Höganäs, Inc.

<table>
<thead>
<tr>
<th>Session</th>
<th>Country</th>
<th>Time</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>027 USA</td>
<td><strong>9:30 a.m.</strong></td>
<td>Improving Additive Manufactured Parts with Aluminum Ion Vapor Deposition</td>
<td>Janusz Kowalewski, Ipsen</td>
<td></td>
</tr>
<tr>
<td>030 USA</td>
<td><strong>9:55 a.m.</strong></td>
<td>A Method for Quantification of the Level of Re-Use of Powder Feedstock in Powder Bed Additive Manufacturing</td>
<td>Tho X. Bui, Honeywell Aerospace</td>
<td></td>
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<tr>
<td>018 USA</td>
<td><strong>10:20 a.m.</strong></td>
<td>Recycling Powder Bed Metals Efficiently to Maximize Productivity In Additive Manufacturing</td>
<td>Gregory K. Riter, Elcan Industries</td>
<td></td>
</tr>
</tbody>
</table>
### POWDERMET TECHNICAL SESSIONS
**Wednesday Morning** 11:00 a.m.–12:15 p.m.

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Time</th>
<th>Location</th>
<th>Presenter(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SESSION 30</strong></td>
<td>Advanced Processing</td>
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<tr>
<td></td>
<td>Functional Porous Metals Through Powder Metallurgy via Intraparticle Expansion</td>
<td>11:00 a.m.</td>
<td>USA</td>
<td>Samuel Brennan, Millersville University</td>
</tr>
<tr>
<td></td>
<td>Process for Metallic and Metallic Alloy Powder Conditioning</td>
<td>11:25 a.m.</td>
<td>USA</td>
<td>Makhlouf Redjdal, Amastan Technologies, LLC</td>
</tr>
<tr>
<td></td>
<td>Effect of Thermal Cycling on Thermal Conductivity of Powder Injection Molded Multiwall Carbon Nanotube Reinforced Copper Matrix Nano Composite</td>
<td>11:50 a.m.</td>
<td>Malaysia</td>
<td>Faiz Ahmad, Universiti Teknologi PETRONAS</td>
</tr>
<tr>
<td><strong>SESSION 31</strong></td>
<td>Titanium Alloys</td>
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<tr>
<td></td>
<td>Mechanical Properties of Beta 21S Alloy Produced by Hydride Dehydride Process</td>
<td>11:00 a.m.</td>
<td>USA</td>
<td>George Bernhard, GKN Hoeganaes</td>
</tr>
<tr>
<td></td>
<td>Molten Salt Electrochemical Process for the Production of Metal Powder and Complex Alloys</td>
<td>11:25 a.m.</td>
<td>United Kingdom</td>
<td>Ian Margerison, Metalysis Ltd</td>
</tr>
<tr>
<td></td>
<td>Review of Laser Cladding/Direct Metal Deposition for Titanium Alloy Powders</td>
<td>11:50 a.m.</td>
<td>Canada</td>
<td>Colin McCracken, Oerlikon Metco (Canada), Inc.</td>
</tr>
</tbody>
</table>

### STUDENT POSTER SESSIONS
**Wednesday Morning** 11:00 a.m.–12:15 p.m.
Machinability: Modeling and Practice of PM Machining

Program Organizers:
Carl Blais, Laval University
Denis Christopherson, PMT, Federal-Mogul Sintered Products

Session Chairman:
Gilles L’Esperance, Ecole Polytechnique de Montreal

195 Germany
Innovative Use of Statistics and Design of Experiments for PM Machining Optimization
Thorsten Upmeier, Federal-Mogul Burscheid GmbH

217 USA
Tools and Methods for Understanding Machinability in PM
John Engquist, FAPMI, JENS Solutions, Inc.

241 Japan
Powder Metal Machining Using CBN Materials
Hironari Moroguchi, Sumitomo Electric Hardmetal Corporation

Machining of powder metallurgy materials is a critical practice for most PM applications, often defining fit, form, function, and financial success. The process of machining PM materials is arguably more complex than cast and wrought materials, and tools and techniques used for the latter are not optimized for the former. This Special Interest Program will offer perspective toward typical PM machining challenges and methods to measure, analyze, and improve the machining process. Within the program, focused presentations include PM material advances, tool technology, machining process characterization and case studies, providing a wide scope of ideas and concepts useful to anyone involved in PM machining.

Individual presentation times will run 25 minutes, including questions. Manuscripts that are submitted will be published in the conference proceedings.

Directed Energy Deposition

Session Chairman: Ankit Saharan, EOS

281 USA
DED of Inconel 718 and the Impact of Powder Quality
Aaron LaLonde, BeAM Machines

288 USA
High-Power Diode Laser in Cladding, Additive and Hybrid Manufacturing
Oleg Raykis, Laserline, Inc.

Build Atmosphere Attributes

Session Chairman: Eric Johnson, Deere and Company

065 Germany
Influence of Gas-Flow System on Density and Microstructure of Additively Manufactured Nickel-Based Superalloy 718
Nikolay Molodtsov, Baker Hughes, a GE Company

091 United Kingdom
The Importance of Maintaining Build Environment Quality for Sustained Powder Life
Lucy Grainger, Renishaw, Inc.

Refractory Materials

Session Chairman: Howard A. Kuhn, University of Pittsburgh

133 USA
Evaluation of AM Tantalum Feed Powder on Part Physical Properties and Microstructure
Aamir D. Abid, Global Advanced Metals

100 Finland
Additive Manufacturing of Refractory Metals Is Here
Riku T. Ruohomaa, Electro Optical Systems Finland

093 USA
Feasibility Study of Pure Tungsten for Bulk Parts
Alexander L. Janzen, EOS North America

095 Canada
The Use of Direct Metal Deposition Additive Manufacturing Technique for Large Builds, Repair, Hard Facing and Multi-Material Deposition
Arshad Harooni, DM3D Technology

108 USA
Chemical Composition and Mechanical Behavior of Laser Melted Cladding/Tool Steel Interfaces
Trevor W. Verdonik, Lehigh University

261 USA
Atmosphere Design for Better Powder Bed Additive Manufacturing
Liang He, Air Products and Chemicals, Inc.

113 USA
Influence of Gas-Flow System on Density and Microstructure of Additively Manufactured Nickel-Based Superalloy 718
Nikolay Molodtsov, Baker Hughes, a GE Company

133 USA
Evaluation of AM Tantalum Feed Powder on Part Physical Properties and Microstructure
Aamir D. Abid, Global Advanced Metals

100 Finland
Additive Manufacturing of Refractory Metals Is Here
Riku T. Ruohomaa, Electro Optical Systems Finland

093 USA
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Alexander L. Janzen, EOS North America

095 Canada
The Use of Direct Metal Deposition Additive Manufacturing Technique for Large Builds, Repair, Hard Facing and Multi-Material Deposition
Arshad Harooni, DM3D Technology

108 USA
Chemical Composition and Mechanical Behavior of Laser Melted Cladding/Tool Steel Interfaces
Trevor W. Verdonik, Lehigh University

261 USA
Atmosphere Design for Better Powder Bed Additive Manufacturing
Liang He, Air Products and Chemicals, Inc.
INTERNATIONAL POSTERS dealing with various aspects of PM and particulate materials technologies will be displayed daily starting on Monday morning. Authors will be available at their posters for discussion Monday (5:00–6:30 p.m.) during the PM Evening Alehouse. Manuscripts submitted from poster authors will be published in the conference proceedings.

“Outstanding Poster” and “Poster of Merit” awards will be given by the Poster Awards Committee for displays that best meet the established criteria. Award ribbons will be posted prior to the designated discussion period on Monday.

Student Poster Sessions also have dedicated times throughout the conference. See the Daily Schedule for details.

Additionally, 44 National Science Foundation Grant recipients and CPMT student posters will be on display.

POSTER A: MATERIALS

020  Sweden
The Heterogenic Structure Formed During Electron Beam Melting of 316L Stainless Steel
Jon Olsen, Stockholm University

113  USA
Additive Manufacturing of Soft Magnetic Composites
Kyle J. Matthews, Drexel University

211  USA
Investigation of Selective Laser Melted 4340 Steel Fabricated at High Laser Power
Maria A. Castro, Lehigh University

POSTER B: PROCESSING

196  USA
Tuning Sintered Density of Binder-Jet Components Independent of Sintering Shrinkage
Mohsen Ziaee, University of South Florida

POSTER C: PROPERTIES

048  Canada & China
Characteristic Features of Carbonyl Ferronickel Powders
Jun Shu, Cnem Corporation

216  Brazil
Effect of Ni Additions and Sub-Zero Treatment in the Mechanical and Tribological Properties of Self-Lubricating Steels Produced by MIM
Aloisio N. Klein, Universidade Federal de Santa Catarina Brazil

228  USA
Mechanical Analysis of Spherical Powder After Spreading via Micro-Scale Test Bed
Darryl J. Scott, North Carolina Agricultural and Technical State University

271  USA
Design of Functionally Graded Metallic Plates for Use in Personal Ballistic Protection
Elizabeth Keys, California State University, Sacramento

274  USA
Characterization and Analysis of Functionally Graded Metallic Plates For Use In Personal Ballistic Protection
Samuel Garrison-Terry, California State University, Sacramento

STUDENT GRANT POSTER PROGRAM

Continuing our quest to introduce the science of PM to students, 40 National Science Foundation (NSF) and 4 CPMT/Axel Madsen Conference Grant recipients will prepare project posters on powder metallurgy to be displayed during the conference. Additionally, each recipient will present a 10-minute synopsis of the poster during a scheduled poster session. Grant recipients and their poster titles will be available on the conference website.

MPIF is grateful to the National Science Foundation for its support of students to attend the POWDERMET2018 & AMPM2018 annual conferences. This support provides student participants with opportunities to exchange ideas with leading researchers and engineers from worldwide industrial and governmental facilities, as well as with students and faculty from both domestic and international universities. Student participants will learn the latest research areas and results in powder metallurgy fields of interest. These opportunities will not only improve the students’ knowledge in the field, but also develop scientists and engineers who are ideally suited to create the next generation of designs in powder metallurgy and metal additive manufacturing that will push materials and manufacturing capabilities.

The Axel Madsen Conference Grant Program was established by the Madsen family to encourage students to learn more about PM technology and eventually pursue careers in the PM industry.
GENERAL INFORMATION

CONFERENCE VENUE & HEADQUARTERS HOTEL
All conference events will take place at:

Grand Hyatt San Antonio
600 E. Market Street
San Antonio, TX 78205
sanantonio.grand.hyatt.com

CONFERENCE DATES
Sunday, June 17 – Wednesday, June 20, 2018

SPONSORS
Metal Powder Industries Federation
APMI International
105 College Road East
Princeton, New Jersey 08540-6692
Telephone: (609) 452-7700
Fax: (609) 987-8523
E-mail: info@mpif.org
www.mpif.org
www.apmiinternational.org

REGISTRATION
• Register and reserve hotel rooms at POWDERMET2018.org or AMPM2018.org.
• Advance registration discounts are for a limited time and will guarantee participation in selected events.
• Payment must accompany registration by May 4 to qualify for lowest rates.
• Rates increase after May 4.
• Higher rates apply for registration on site.
• MPIF and APMI International members receive discounted rates.
• Children under the age of 17 will not be permitted.

13th Annual APMI International Golf Tournament
Transportation will depart from the Grand Hyatt San Antonio at 7:00 a.m. Breakfast will be provided.

Brackenridge Park Golf Course, which is the oldest public golf course in Texas, was the first ever to host the Texas Open Golf Tournament in 1922. It was the first course to be inducted into the Texas Hall of Fame. The course offers challenges for golfers of all levels—water comes into play on a few holes, with numerous doglegs and well-placed bunkers to watch out for. Elevated greens and tight fairways lined with trees add to the challenge and fun at Brackenridge Park Golf Club.

Attendees may register as a foursome or as individuals. To sponsor a foursome, please contact Diane Haggerty (dhaggerty@mpif.org).

Attire: Course dress code is soft spikes, slacks, Bermuda shorts, and shirts with sleeves and collar.

Cancellation Policy: There are no refunds for cancellation of the golf tournament.

Tournament Fee: $140.00 – includes transportation, breakfast, green fees and cart.

Rental Clubs: $50.00 per set

Participation in the tournament may be limited. Sign up early to reserve your spot!
STUDENT REGISTRATION
(Non-NSF/CPMT Grant Recipients)
The student rate includes:
• Opening General Session and technical events for both co-located conferences (POWDERMET2018 & AMPM2018)
• Exhibit hall admission
• Industry Luncheon and the PM Design Excellence Award Luncheon*
• Preprints and the post-conference digital proceedings for POWDERMET2018 technical manuscripts, as well as post-conference AMPM presentations
• Registration bag with handouts
To qualify for the student rate, you must:
• Be enrolled as a full-time engineering student who is not employed in the industry
• Provide proof of active student status with your conference registration
• Provide the university name as your organization when you register for the conference
*Meal tickets for the Opening Night Reception and the Closing Event—Boots and Blue Jeans: A Texas BBQ are not included in the student package. These tickets must be purchased separately.

MEAL TICKET SALES
Additional tickets for the Opening Night Reception, the Industry and PM Design Excellence Awards Luncheons, and the Closing Event—Boots and Blue Jeans: A Texas BBQ will be available for purchase only to:
• Daily registrants
• POWDERMET/AMPM conference registrants
• Accompanying spouses/guests of full-conference registrants
• Exhibitor personnel
• Students
Individual meal ticket sales are intended as add-ons to existing conference registrations. Individuals who are not conference registrants, as listed above, will not be able to purchase meal tickets.

ADMISSION TO EXHIBIT HALL
• Admission to the exhibit hall is included as part of full-conference and daily registration rates.
• Exhibit-only admission is not available for purchase.
• Qualified PM parts manufacturers are eligible for complimentary exhibit passes. Please visit POWDERMET2018.org or AMPM2018.org for details.

CANCELLATIONS AND REFUNDS
• Registration cancellations and refunds are only accepted in writing.
• If you cancel by telephone, you must still confirm by email or fax at the time of cancellation in order to receive a refund.
• A 20% cancellation fee will be deducted from refunds on all cancellations received through June 1 (no refunds for the APMI Golf Tournament). No refunds will be given after this date.
• Individuals who fail to cancel in writing by June 1 and do not attend the conference will be subject to the full fee.

Important: If you do not receive a cancellation acknowledgment within 2–3 business days, please contact Stephanie Schember at sschember@mpif.org.

REQUEST FOR FOREIGN VISAS
Some travelers entering the U.S. must obtain a visa and should apply for a visa as early as possible due to U.S. government increased security and entry requirements. Request a special letter of invitation at POWDERMET2018.org or AMPM2018.org. For further questions, contact Stephanie Schember at sschember@mpif.org.

SUGGESTED DRESS
Business or business casual attire is appropriate for all conference events. Casual attire is appropriate for the Closing Event—Boots and Blue Jeans: A Texas BBQ.

PEOPLE WITH DISABILITIES
Attendees with disabilities that require special needs should contact MPIF (dhaggerty@mpif.org) in advance so that arrangements can be made.

GETTING THERE
More than 8.5 million passengers fly into and out of historic San Antonio each year, visiting more than 30 non-stop domestic and international destinations on 10 airlines. San Antonio International Airport is conveniently located just nine miles from the Grand Hyatt San Antonio.

HOTEL RESERVATIONS
Register early to guarantee group rates at the hotel. Higher rates may apply once our room block is filled or after the advance registration deadline of May 4. Room reservations will be acknowledged by email. Hotel rooms before and after the conference may be available but at a higher rate.

SPECIAL CONFERENCE RATE:
Single or Double: $214.00 plus taxes per night.
Internet in the guestrooms is included in the rate, as well as 24-hour access to the fitness center.

HOTEL RESERVATIONS, CHANGES, AND CANCELLATIONS
• Credit card information is required in order to process your reservation. Your card will be charged the first night’s room and tax as a deposit.
• This deposit is refundable for cancellations received at least 48 hours prior to the confirmed day of arrival and cancellation number is obtained.
• For changes to your reservations or to cancel, contact the Grand Hyatt San Antonio.

STAY AT THE HEADQUARTERS HOTEL
You are highly encouraged to stay at the Grand Hyatt San Antonio—the headquarters hotel. Not only will you be at the center of all the activities, but the convenience far outweighs any benefits from staying at other hotels. Please help your association meet its contracted obligations by staying at the headquarters hotel.

RESTRICTIONS ON RECORDING
No photography, or audio or video recording of presentations is permitted.
# Registration Fees and Ticket Prices

<table>
<thead>
<tr>
<th>Registration Type</th>
<th>Advance Paid by May 4</th>
<th>After May 4</th>
<th>On-Site Registration</th>
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<tr>
<td><strong>Full Conference Registration</strong></td>
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<td>(Includes Opening Night Reception, Opening General Session, two luncheons, exhibits, Closing Event, preprints, POWDERMET proceedings, AMPM presentations, and registration bag with handouts)</td>
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<tr>
<td><strong>Includes access to both POWDERMET and AMPM Technical Sessions</strong></td>
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<td>MPIF-Member Company Employees</td>
<td>$1,600</td>
<td>$1,700</td>
<td>$1,850</td>
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<tr>
<td>MPIF-Member (Speakers/Session Chairmen)</td>
<td>1,500</td>
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<td>APMI Member</td>
<td>1,700</td>
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<td>APMI Member (Speakers/Session Chairmen)</td>
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<td><strong>Exhibitor Registration</strong></td>
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<td>(for exhibitor booth staff)</td>
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<td>Exhibitor Package 1</td>
<td>$875</td>
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<td>Exhibitor Package 2</td>
<td>375</td>
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<td><strong>Opening Reception and Closing Event purchased separately.</strong></td>
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<td>Spouse Registration</td>
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<td>(Includes Opening Night Reception, PM Evening Alehouse and Closing Event)</td>
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<tr>
<td>Student Registration</td>
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<td><strong>Opening Reception and Closing Event purchased separately.</strong></td>
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<tr>
<td>Daily Registration</td>
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<td>(Includes technical sessions and exhibit only, plus registration bag with handouts.)</td>
<td>$850</td>
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<tr>
<td><strong>Purchase meals or proceedings separately.</strong></td>
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<tr>
<td>Monday</td>
<td>$850</td>
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<td>Tuesday</td>
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<td>Wednesday</td>
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<tr>
<td>Exhibit-Only Admission</td>
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<tr>
<td>Free to qualified PM parts manufacturers only. Exhibit is included with full or daily packages above.</td>
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<tr>
<td>POWDERMET2018 Digital Proceedings</td>
<td>$750</td>
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<td>AMPM2018 Digital Presentations</td>
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<td>(Included with full conference and student registration, cost for additional copies)</td>
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<tr>
<td>Meal Tickets</td>
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<td>(Meals are available only to full conference registrants, spouses, students, and exhibitor personnel)</td>
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<tr>
<td>Sunday: Opening Night Reception</td>
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<tr>
<td>Monday: PM Design Excellence Awards Luncheon</td>
<td>80</td>
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<tr>
<td>Tuesday: Industry Luncheon</td>
<td>80</td>
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<td>95</td>
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<tr>
<td>Tuesday: Closing Event: Boots and Blue Jeans: A Texas BBQ</td>
<td>375</td>
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<td>400</td>
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<tr>
<td>APMI Golf Tournament (Sunday)</td>
<td>$140</td>
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<td>Tournament Fee</td>
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<tr>
<td>Club Rental</td>
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</tbody>
</table>

Register and reserve hotel online at [POWDERMET2018.ORG](http://POWDERMET2018.ORG) or [AMPM2018.ORG](http://AMPM2018.ORG)
Make the Most of Your Conference Experience

From attendees to exhibitors or from speakers to students, networking is one of the most important functions of a conference. Form or strengthen relationships, get face-to-face time with customers or students, and ask follow-up questions to researchers in your field. Gain customers, suppliers, colleagues, or mentors.

Networking Opportunities

- **OPENING NIGHT RECEPTION**
  Don't miss the kick-off celebration to the entire conference as attendees are welcomed to San Antonio. Say hello to old and new friends and learn the latest industry buzz.

- **PM DESIGN EXCELLENCE AWARDS LUNCHEON**
  A luncheon highlighting the winners of the 2018 PM Design Excellence Awards that provides an opportunity to learn about new uses of PM and the top companies in the industry.

- **PM EVENING ALEHOUSE**
  Grab a beverage and shake hands with exhibitors, poster authors, and fellow attendees.

- **INDUSTRY LUNCHEON**
  A luncheon recognizing key industry individuals, this luncheon is an opportunity to connect big names with faces.

- **CLOSING EVENT—BOOTS AND BLUE JEANS: A TEXAS BBQ**
  Grab your cowboy boots and discuss what you've learned while connecting with other attendees at the biggest social event of the conference.

Conference Networking 101

- **PREPARE. PREPARE. PREPARE.**
  1. Download the Conference App.
  2. Review the program.
  3. Find out who's going.
  4. Schedule meetings at the AM/PM Café.

- **ONCE YOU’RE THERE**
  1. Connect with colleagues and/or customers.
  2. Utilize evening social events—the informal setting is a good way to get to know people.
  3. Don't hesitate to ask questions or seek out speakers or exhibitors at social events.
  4. Make time to attend the exhibit hall.
  5. Visit the poster sessions.

- **POST-CONFERENCE**
  1. Follow up with people you met by connecting on LinkedIn or sending them a quick email.
  2. Share what you have learned with co-workers.

TIP: Put Away the Smartphone—nothing beats face-to-face interaction.
The potential of powder metallurgy is only limited by one’s imagination…

GKN Hoeganaes is a world leader in the development and production of metal powders.

Over 65 years, our commitment to innovative technologies spans critical applications from Automotive to Additive Manufacturing.

GKN Hoeganaes has expanded our global footprint to meet our customers’ needs, with powder production facilities in North America, Europe and Asia.
June 17–20, 2018
Grand Hyatt San Antonio

Two Big Conferences—One Big City!

June 17–20, 2018
Grand Hyatt San Antonio

Visit POWDERMET2018.org or AMPM2018.org for program details.