

May Meeting Announcement: Past Chairs' Night and Awards Night

Day / Date: Thursday, May 18th 2017

Location: Penn Brewery Restaurant

Address: 800 Vinial Street, Pittsburgh PA 15212

Time: 06:00 PM – 08:30 PM

Speaker: Paul Allen, V.P. Quality Assurance, TIMET

Topic: Reflections on Business and Technology Trends in the Titanium Industry

Student speaker: Amir Mostafaei

Topic: Microstructure and Mechanical Behavior of Binder Jet Additive Manufactured Alloy 625

Agenda:

6:00 – 6:30 PM – Social & Registration

6:30 – 7:15 PM – Dinner

7:15 – 7:25 PM – Student presentation by Amir Mostafaei

7:30 – 7:40 PM – Awards and Recognition of Past Chairs

7:40 – 8:25 PM – Presentation by Paul Allen

8:25 – 8:30 PM – Announcements and wrap up



Mr. Paul Allen

Abstract

The titanium industry is still a relatively young industry in the primary metals production sector. Commercial Titanium production began in the early 1950's, founded mainly on military aerospace applications. Today, the aerospace industry is still the predominant market sector with the volume more focused on commercial applications. The speaker has been involved with the aerospace titanium sector for almost his entire professional career. The presentation will review some of most significant industry events both in terms of business and technology and how they have effected changes in the industry from both the manufacturer's and OEM perspectives. The Pittsburgh area has significant history in this industry and several local manufacturing plants are still major players in sectors of the titanium market today.

Speaker

Mr. Allen graduated in 1977 with a BS degree in Materials Engineering from Loughborough University in the UK. He started his career with Rolls Royce Aero-Engine group in Derby in 1979, where he has held various positions in the quality control and materials engineering functions associated with major rotating parts. In 1991 he joined TIMET, based in Henderson, NV, and has held various positions within the R&D and corporate quality functions of TIMET. In 2003 he relocated to Pittsburgh and assumed the responsibility for the Quality and Technology group at TIMET's Toronto, OH plant, the wrought processing facility for TIMET's North American operations. In 2009 he was appointed to the position of V.P. Quality Assurance for TIMET. During 2008 to 2012 he held various positions within the ASM Pittsburgh Golden Triangle Chapter and was the Chair for the 2011-2012 program year before relocating to Henderson, NV in 2012.

(Continued on Page 7)

June Social:

Carrie Furnace Tour & Picnic at Schenley

Day / Date: Saturday, June 17, 2017

Agenda:

Carrie Furnace Tour: 3:00 - 5:00 PM

Picnic at Schenley: 5:00 - 7:00 PM

Tour Location: Carrie Furnace

Tour Address: Carrie Furnace Blvd,
Swissvale, PA 15218

Picnic: Catered, at Schenley Park

There is a playground nearby for the kids

Picnic Address: Bartlett Shelter,
Schenley Park, Bartlett St., Pittsburgh,
PA 15217



Carrie Furnace:

Carrie Furnace is a derelict former blast furnace located along the Monongahela River in the Pittsburgh area industrial town of Swissvale, Pennsylvania, and it had formed a part of the Homestead Steel Works. The Carrie Furnaces were built in 1884 and they operated until 1982. During its peak, the site produced 1,000 to 1,250 tons of iron per day. All that is left of the site are furnaces #6 and #7, which operated from 1907 to 1978, along with the hot metal bridge.

Towering 92 feet over the Monongahela River, constructed of 2.5" thick steel plate and lined with

(Continued on Page 3)

Letter from the Chair:

Wow, time flies when you are having fun! Unlike Pittsburgh's winter, which passed unnoticed, the last few meetings have been incredible. Over 100 attendees joined us for Young Members' Night in February to hear Dr. R.J. Lee's thoughtful and insightful discussion of the past, present and future of materials science and engineering. As always, there is a lot to do at the YMN meeting—poster competition, awards, and speakers— and thanks to the hard work of the Young Members' Night committee this year was again a success! January featured a great presentation on failure analysis litigation by ASM trustee Larry Hanke, and March saw a packed Pittsburgh Night for a collaborative talk from Dr. George Shannon and Dr. Scott Story in Monroeville. In April, we returned to Lombardozzi's for an informative talk from Dr. Men G. Chu on casting of aluminum alloys. Piyamanee "Nee" Komolwit deserves much praise for this year's programming. In May, we will welcome back past chair Paul Allen all the way from Nevada, and a fun social event is planned at the Carrie Furnaces in June.

The monthly meetings, every third Thursday of the month are of course, just part of the opportunities from your Chapter. Parag Bedekar continues to organize great outreach opportunities for our chapter including some neat demonstrations at National Engineering Week in February and the judging of the Pittsburgh Regional Science Fair. Thanks to the suggestion of a chapter member, we introduced a fun Nitinol shape memory "ASM" at National Engineering Week!

Equally as important, the efforts of Betsy Clark have produced this exceptional newsletter that has been praised by many throughout ASM. George Shannon has also undertaken the task of pulling together our yearbook, which should be distributed soon! The chapter has also undertaken a project to better involve our sustaining members and will be hosting a Minicamp for about 400 students next year at MS&T in October. The work of your chapter has been shouldered by many volunteers, but we need more hands to make our chapter run smoothly. Please contact me if you are interested in helping to make our chapter the best it can be.

Although the chapter year is ending, our work will continue. The chapter's 100th anniversary is approaching and we have started to receive some wonderful memories. For instance, did you know that a record-breaking 476 people attended a regular chapter meeting to hear Tom Campbell, then Editor-in-Chief of Iron Age magazine speak? Look for fun facts and stories like these in the newsletter as we do a little research to share with you the history of your chapter. And if you have any stories or memories of your own, please send yours in too!

Again, I speak for the entire executive committee that works hard to deliver the best program possible to you when I say I hope that we are providing value both as a way to stay in touch with each other and relevant topics as well as develop a connection to the materials professionals of tomorrow. We are always happy to have input and are looking for executive committee members to help celebrate the past and shape the future of our chapter. I can always be reached at neisinger@perrymanco.com with any comments or suggestions. It has been a great year. Here's to many more!



Mr. Nathan Eisinger
ASM Pittsburgh Chapter Chair 2016-17

Staff Metallurgist
Perryman Company
213 Vandale Drive
Houston, PA 15342
Phone (office) : 724-746-9390
email: neisinger@perrymanco.com



Thomas Wogens (front) assisted by Markus Chmielus (back) demonstrates memory wire at Engineers Week

ASM Pittsburgh Showcases Materials Science at Engineers Week

ASM Pittsburgh hosted a booth for National Engineers Week: Engineer the Future 2017, celebrated at Carnegie Science Center on Saturday, March 25. Peter Kozlowski, Charles Fryman, Bob Wesolowski, Thomas Wogens, Markus Chmielus, and J. Brian Hall volunteered at this fun event. Parag Bedekar organized and oversaw ASM Pittsburgh's participation. In addition to regular demonstrations of thermal expansion, density, and phase changes, they introduced a low temperature Nitinol shape memory alloy experiment. Peter Kozlowski obtained several Nitinol wires programmed in different shapes such as a flower and "ASM" (see photo, left). "This was a very exciting exhibit that was well received by kids and even adults!" said Parag Bedekar, chair of Student Awareness for the Pittsburgh Chapter. Thank you again to the volunteers who engaged folks of all ages on the many exciting aspects of materials engineering!

June Social:

(Continued from Page 1)

refractory brick, Carrie Furnaces #6 and #7 are extremely rare examples of pre-World War II iron-making technology. Since the collapse of the region's steel industry in the 1970s and 1980s, these are the only non-operative blast furnaces in the Pittsburgh District to remain standing.

During the 1920s, 1930s, and 1940s, Carrie Furnaces #6 and #7 consumed approximately four tons of raw materials comprised of iron ore, coke, and limestone for every ton of iron produced. The cooling system for the blast furnace required over five million gallons of water a day.

Registration Fee with RSVP (no/late RSVP, add \$5):

ASM Members: \$35.00

Non-ASM Members: \$40.00

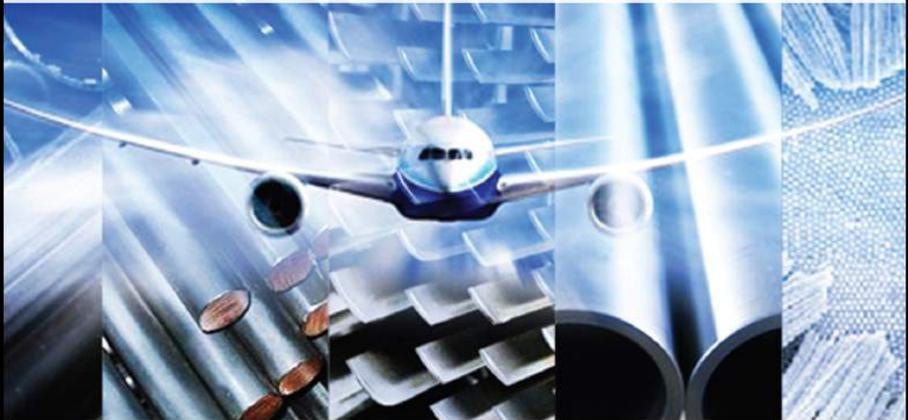
ASM Retiree: \$25.00

Material Advantage Member: \$25.00

Kids under age 15: \$15.00

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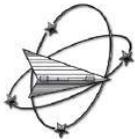
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February Meeting Summary: Young Members' Night

The ASM Pittsburgh Chapter welcomed over 55 students from Carnegie Mellon University (CMU), University of Pittsburgh (Pitt), and Robert Morris University (RMU). The students were joined by professionals, including those from companies who sponsored the event. In addition to a presentation by guest speaker Dr. Richard J. Lee, the evening opened with a poster contest (featuring 21 posters!) and a presentation from Mr. Farzin Fatollahi-Fard, a Ph.D. student at CMU.

Mr. Farzin Fatollahi-Fard, opened the evening with his presentation “The Electrochemical Production of Titanium by the MER Process.” Mr. Fatollahi-Fard began by explaining the current process for the production of titanium sponge, from carbochlorination through distillation through the Kroll process, which has a relatively high cost when compared to, for example, stainless steels. The motivation, then, is to have a process on par with stainless steel production, one that is less sensitive to impurities and, therefore, can use lower grade ores.



Mr. Farzin Fatollahi-Fard, Student Speaker

The MER process takes its name from the Materials and Electrochemical Research Corporation of Tucson, Arizona and reduces TiO_2 with carbon at $1600^\circ C$ to make Ti_2OC . The latter is placed into a cell as the anode and titanium plates out as a powder at the cathode. Using a phase diagram to provide insight into the properties of Ti_2OC , Mr. Fatollahi-Fard explained that when using real feedstock ores, the cathode can become “a giant mess of impurities.” However, some components (such as those containing Fe, Mn, and Cr) are reducible. Thus, a modification to the MER process that would allow *in situ* reduction would open the door for the use of lower grade ores.

To accomplish this, the electrical potential of the anode has to be carefully controlled, allowing each impurity to plate out on the cathode, with the cathode being replaced after each reduction. So far, Mr. Fatollahi-Fard has been able to produce ASTM Grade 2 material with only this modification to the MER process and no requirements for additional equipment.

Mr. Allan Hutt then presented the **Past Chariperson's Education Assistance Scholarships**, shown below:

Outstanding College Sophomore

Gaurav Balakrishnan CMU

Outstanding College Junior

Yushuan Peng CMU

Outstanding College Senior

Eamonn Hughes Pitt
David Ott CMU



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Winners of the ASM Pittsburgh YMN Poster Contest (from left to right): Graduate students Ross Cunningham (CMU, 1st), Isha Kashyap (CMU, 2nd), Shivram Sridhar (CMU, 3rd), and undergraduate students, Colleen Hilla (Pitt, 1st), Heather Bowman (CMU, 2nd), Katerina Kimes (Pitt, 3rd) awarded by Nate Eisinger, Chair



Dr. Richard J. Lee, CEO of RJ Lee Group, gave a talk on “The Materials Scientist: Living at the Intersection of Science, Engineering, and Public Policy.”

Mr. Nate Eisinger named the winners of the **Poster Contest** as shown in the table below:

Undergraduate Winners

- 1st: **Colleen Hilla**, Pitt, “Effect of Print Parameters on the Microstructure of EBM Printed Ti-6Al-4V”
- 2nd: **Heather Bowman**, CMU, “Fabricating Aneurysm Models to Test New Stroke Treatment”
- 3rd: **Katerina Kimes**, Pitt, “Additive Manufacturing of Magnetocaloric Material for High Efficiency Cooling”

Graduate Winners

- 1st: **Ross Cunningham**, CMU, “Analyzing the Effects of Powder and Post Processing on Porosity in Electron Beam Melted Ti-6Al-4V Using Synchrotron XCT”
- 2nd: **Isha Kashyap**, CMU, “Characterization of Magnetic Microstructure in Multifunctional Materials”
- 3rd: **Shivram Sridhar**, CMU, “Simulation of Texture in NiTi Using Visco-Plastic Self Consistent Algorithm”

After the student awards, the evening’s featured speaker, **Dr. Richard J. Lee**, took the podium. Dr. Lee is the CEO and a founding member of the RJ Lee Group, a sustaining member of the ASM Pittsburgh Chapter, based in Monroeville, PA. Dr. Lee has a B.S. in Physics from the University of North Dakota and holds a Ph.D. in Theoretical Solid State Physics from Colorado State University. He has

published over 200 scientific works and holds six U.S. patents.

To inspire the future professionals in attendance, Dr. Lee started by recalling his early years growing up in rural North Dakota, fifty miles by horse from the nearest railroad station, in a house with no modern luxuries like indoor plumbing. Although he started in a one-room schoolhouse, by eighth grade he was attending the town school, which was much larger with 64 students.

The inspiration to study materials, however, came not from school, but out in the open on the Great Plains where, one night, he and many others watched Sputnik, which had been launched earlier that day by the Soviet Union, pass overhead. The event that started the U.S. space program necessarily sparked a demand for new and better materials, and captivated the imagination of a generation of scientists like Dr. Lee. Years later a nano-particle sampler developed by RJ Lee Group would be aboard the International Space Station.



Pittsburgh Chapter PCEAS Scholarship Winners: Seniors Eamonn Hughes (Pitt) and David Ott (CMU), Sophomore Gaurav Balakrishnan (CMU), and Junior Yushuan Peng (CMU) are awarded by Allan Hutt.



YMN Committee from left to right: Zhimin Sun (Pitt), Chase Royer (RMU), Katerina Kimes (Pitt), Taylor Russo (Pitt), Shuchen Cong (CMU), Christine Rooney (CMU), Heather Bowman (CMU), Rafael Giacomini (CMU), Elizabeth Clark (YMN Chair), Bennet Monnie (RMU). Not pictured: David Sapiro (CMU), Carolyn Norwood (Arconic), and Anil Chikkam (EXOVA)

Dr. Lee illustrated the evolving necessity for better materials with “The War Horse,” a movie which depicts a horse in WWI caught between high-tech Germans with tanks, barbed wire, and machine guns and low-tech Frenchmen with antiquated weapons and horses. An early material development for defense was a higher quality horseshoe. Today’s airplanes, tanks, transportation systems, and protective gear all resulted from improvements to the materials used in them.

Dr. Lee also touched on forensic engineering, which he likened to the questions asked by any curious child: “How does it work?” “What made it break?” He highlighted the capabilities of RJ Lee Group including some innovations they have developed such as an automated SEM and a tire burning plant in Mississippi. Dr. Lee believes that three things have made RJ Lee Group successful: analytical instruments, information management, and professional expertise. In addition to the technology, RJ Lee Group employs 200 employees from diverse background of specialties and education levels.

In concluding, Dr. Lee asked what the future may look like for the young members present. With an elongation vs. tensile strength curve, he showed where the third generation of Advanced High Strength Steels would reside. He also emphasized the materials genome project and other information-driven initiatives that will help design materials with the least amount of direct testing and experimentation.

The YMN Committee would like to thank our sponsors for this event: Arconic, Allied High Tech Products, Inc., American Stress Technologies, ATI, Carpenter Technology Corp—Latrobe Specialty Metals, Elliott Group, The Perryman Company, Product Evaluation Systems, Inc., and Westmoreland Mechanical Testing and Research, Inc.



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May Meeting: (Continued from Page 1)

Student Abstract

Binder jet printing (BJP) is an additive manufacturing method in which powder is deposited layer-by-layer and selectively joined in each layer with binder. Since the powder does not get melted during printing, the density after printing (green density) is around 50% and heat treatments are needed to densify parts. We investigated the influence of differently atomized alloy 625 powder, including water - and gas-atomized powder (WA and GA, respectively), as well as thermal process parameters on density, microstructure and mechanical properties of printed parts. GA printed samples achieved higher sintering density (99.2%) than WA samples (95.0%) due to differences in powder morphology and chemistry. Mechanical tests were conducted on optimally sintered samples and sintered plus aged samples; aging further improved microstructure and mechanical properties. This study shows that microstructural evolution (densification, and carbide, oxide and intermetallic phase formation) is very different for GA and WA binder jet printed and heat-treated samples.



Mr. Amir Mostafaei

Student Bio

Amir Mostafaei has a B.Sc. in Materials Science and Engineering from the Islamic Azad University-Science and Research Branch, Tehran, Iran. He has an M.Sc. in Materials Engineering-Corrosion and Protection of Materials from Sahand University of Technology, Tabriz, Iran. He is a 3rd-year PhD student working on additive manufacturing of nickel-based superalloys and magnetic shape memory alloys in Professor Markus Chmielus' lab.

Register:

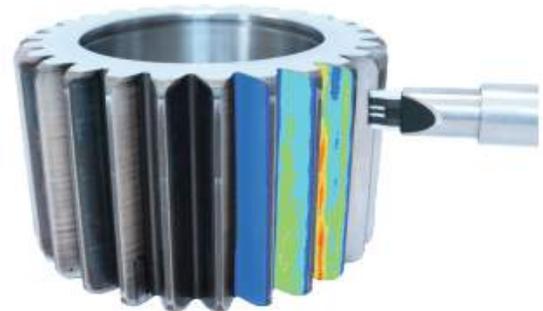
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January Meeting Summary

For National Officers' Night, ASM Pittsburgh hosted ASM trustee, **Mr. Larry Hanke, P.E., FASM**. Mr. Hanke began the evening with an update on changes and activities at Materials Park, which just completed major renovations including new laboratory facilities. Under the direction of a new managing director, ASM will be transferring from paper to electronic format to be better equipped to deliver detailed technical information to members of the world's largest materials organization (some of this work includes updating databases). He complimented the work of the Emerging Professionals Committee (EPC) that continues to contribute to the direction of ASM and encouraged others to get involved. Mr. Hanke also introduced the new Failure Analysis Society affiliate, of which he is a member, linking with the evening's topic of **"Forensic Materials Engineering for Product-Liability Litigation."**

Mr. Hanke is the principal engineer and founder of Minneapolis-based Materials Evaluation and Engineering, Inc. and shared some interesting cases from a variety of clients. Mr. Hanke emphasized that anything made by humans is destined to fail at some point, and the consequences can have economic implications, especially if the failure causes damage or injuries. Often, this is resolved in the court system. As engineers, we face three areas for litigation—design, manufacturing, and warnings. Materials engineers like Mr. Hanke are primarily concerned with the first two.

By a show of hands, only two of the 32 attendees had ever testified in court based on their technical expertise, so Mr. Hanke reviewed the admissibility criteria whereby the judge will allow a presentation to the jury. These include the experts' qualifications, the standard of care they have maintained, and their knowledge of the best practices in their field. Most states base their admissibility guidelines on standards established by a 20-year-old court case known as the "Daubert Standard" after the plaintiff in that case.

To meet the Daubert Standard, observations, calculations, modeling, technical literature, and internal documents are used, and transparency is part of the landscape. ASTM has standards E860 and E1188 for the collection of evidence for potential litigation, and all parties have equal

opportunity to make evaluations. The goal is that professionals are adhering to the highest standards and achieving resolutions. Mr. Hanke then walked the crowd through several case studies, illustrating the pros and cons of the system and process.

The first case showed "the process working at its best," and involved corrosion to truck trailer rails. The trucking company had purchased trailers from Texas, and they operated for five years without any issues. The company ordered 200 more trailers, and within two years corrosion-induced bulges were appearing where the steel cross braces contacted the aluminum side rails. The likelihood of galvanic action at this interface is known to manufacturers, and some use a plastic barrier to prevent it. This trailer manufacturer specified a zinc chromate paint as a barrier but the steel supplier had changed to a standard enamel paint. Like so many issues, communication was at the root of the problem. The manufacturer called for a specification for one paint, while the steel supplier sent certifications showing use of the enamel, and neither caught the mix-up. This case was settled without going to court.

Another case also rested on paperwork, where documents showed that a contractor had used propylene glycol to winterize a sprinkler system in a residential condominium complex. The sprinkler pipes were made of CPVC, for which ethylene glycol was the appropriate antifreeze. Although traces of propylene glycol were present at the surface near the fracture failure, the amounts were not sufficient proof without the documentation that a drum of the liquid had been delivered to the site. SEM images depicted how the plastic appeared to be dissolved in the exposed zone.

Mr. Hanke then presented a case from an *in vivo* hip implant failure that was ultimately resolved by a process improvement. The fractography depicted a progressive mechanism—the joint had failure suddenly after five years in

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Nate Eisinger, Chair (left) and Piyamanee Komolwit, Vice Chair (right) present a token of appreciation to Mr. Larry Hanke, ASM Trustee, for his presentation.

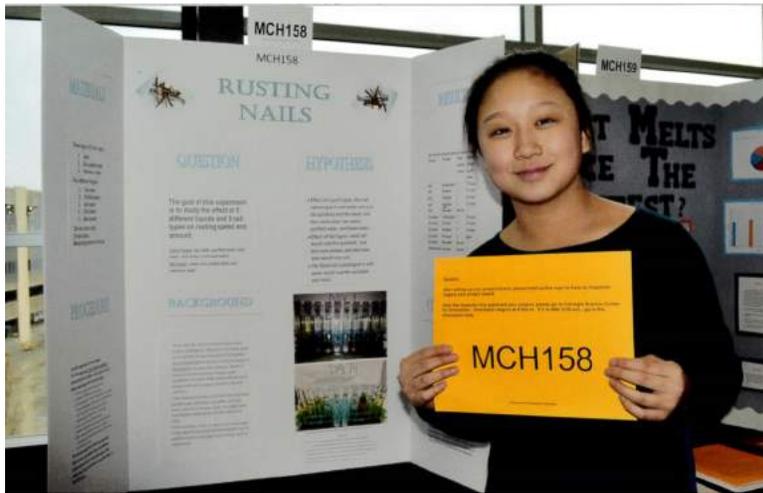


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Ms. Victoria Ren, winner of the ASM Pittsburgh award for her project related to materials science at the Covestro Pittsburgh Regional Science & Engineering Fair.

ASM Pittsburgh Sponsors Award at Science Fair

In 2017, the Covestro Pittsburgh Regional Science & Engineering Fair (Covestro PRSEF) hosted its 78th year of open competition of research projects in the fields of science, mathematics and engineering on March 31 (competition day) and April 1 (awards ceremony) at Heinz Field. Students in grades 6-12 from 23 counties in Western Pennsylvania and Garrett County in Maryland participated in this competition.

Months before the Science Fair, the students developed their projects by utilizing the scientific method. At the Science Fair, they exhibited their research on a presentation board and were interviewed by judges who consisted of the area's most distinguished scientists and engineers. The next day, an award ceremony was held honoring the participants and winners of the Science Fair.

ASM Pittsburgh sponsors one award of \$500 every year to the best project related to materials science at Covestro PRSEF. This year, ASM Pittsburgh also participated as sponsor judges for this award. **Parag Bedekar, Dharma Maddela, and Thomas Wingens** judged 35 projects together and awarded this award to **Victoria Ren** for her project on rusting nails.

Victoria, a seventh grade student, studied the effect of five different liquids—tap, purified, salt, acid, and base water—on the speed and amount of rusting of three different types of nails: steel, zinc-plated, and stainless steel. She found that stainless steel did not rust in the base water, but the remaining combinations did result in rusting. Acid water produced the most severe rusting, particularly in the regular steel and zinc-plated steel. Overall, and true to its name, stainless steel was the most resistant to rusting. Congratulations again to Victoria!

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March Meeting Summary

The focus of the March meeting was inclusions, with both a student presentation and featured speakers addressing this important topic. About 50 people attended at Jaden Catering Restaurant, with many touring the laboratories at sustaining member **R. J. Lee Group** prior to the meeting.

Jia Tan, a fourth-year Ph.D. student in Materials Science and Engineering at Carnegie Mellon University (CMU) started the evening with her presentation, **“Evolution of Steel Inclusions During Reoxidation,”** about modifying small solid oxide-particle inclusions during ladle refining so that they remain in liquid phase. Ms. Tan concentrated on spinel inclusions, with aluminum reducing magnesium after deoxidation, followed by a calcium treatment to modify the spinel to liquid, and finally a reformation of the spinel after reoxidation.

Ms. Tan presented two scenarios, one with the spinel and calcium aluminate and the other with excess calcium sulfide. The analyses, using SEM/EDS automated inclusion analysis were performed immediately after reoxidation, then at intervals of 5, 10, and 20 minutes. One significant result showed that with excess CaS present before reoxidation, fewer new and smaller inclusions will emerge.

Dr. George Shannon and **Dr. Scott Story** then gave a joint presentation, **“Automated SEM Inclusion Analysis as a Tool to Improve Steel Quality and Productivity.”** Dr. Shannon is Principal Development Engineer in the aerospace group at sustaining member Carpenter Technology Corporation, Latrobe Operations, and holds a Ph.D. from CMU with an B.Sc. from Lehigh University. Dr. Story also holds a Ph.D. and M.S. from CMU and a B.Sc. from Monash University in Victoria, Australia. Dr. Story joined the steelmaking and casting group at US Steel Corporation Research and Technology Center in 1998.

Dr. Shannon began by going back in time to an ancient bloomery. In those days, a spongy mass was beat into a solid mass with a hammer, “banging out” inclusions in the process. EDS analysis of inclusions in a miner’s chisel from 400 A.D. revealed the type of fluxing agents used and established that trade had occurred between certain localities because of the known origin of the fluxes. Fast forward in time to “Did inclusions sink the Titanic?” which Dr. Shannon quipped that “actually, it hit an iceberg.” However, MgS inclusions in the steel hull, while considered acceptable for the standards of its era, would be unsuitable today.

The modern sources of inclusions are the same as in the ancient days—vessels, ores/metallics, fluxes, and fuels. Dr. Shannon noted that the

inclusion rating system developed by the Swedish Standards Society no longer says much about inclusions as most of today’s steels have ratings of one (or less). Dr. Shannon reviewed some of the process changes and customer requirements that have occurred in the past century before turning over the floor to Dr. Story.

Dr. Story began with an historic look at US Steel Research’s work on inclusions, starting in 1956, adding an SEM around 1965, and EDS in the 1970s. Beneficial but time consuming, the improvements evolved from the mid-1970s to the mid-1980s with Computer Controlled SEM (CCSEM), much of it spearheaded by Dr. R.J. Lee before he started his own company, the R.J. Lee Group.

Today, Automated Steel Cleanliness Analysis Tool (ASCAT), acquired from Tescan by US Steel Research in 2005, allows inclusions to be segregated into classes. Dr. Story listed many process and product improvements that have resulted from use of the ASCAT, including steel toughness, formability, and permeability (for motor lamination grades). He provided two case studies. First was the effect on Ti-SULC product, which suffered from insufficient slag conditioning when the FeO content exceeded 20% by weight. Second was the effect of Ti,Cb (C,N) inclusions on OCTG casing exposed to sour gas.

Dr. Shannon then wrapped up with a discussion of ASCAT at Carpenter Latrobe which, unlike large integrated

(Continued on Page 11)



Pittsburgh Chapter Chair Nate Eisinger (center) presents speakers Dr. George Shannon (left) and Dr. Scott Story (right) with a token of appreciation.

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March Meeting Summary: (Continued from Page 10)

mills, produces specialty product such as vacuum melted grades, often in ingot form to later be remelted or forged by downstream process customers. The ASCAT is a great tool for metallurgists but, as Dr. Shannon stated, “generating a lot of data is not a solution in itself.” After acquiring one large sum of data, Dr. Shannon must delve into the data to make assessments of product and process quality.

One technique involves plotting the data over a heat sequence then separating inclusions by size, before looking at the inclusion population in each ingot. In one case, an ingot had less inclusion area, and it was then possible to look at how each element was changing on a ternary diagram. On these diagrams, Dr. Shannon showed the benefit of normalizing for population density, similar to the technique presented earlier by Ms. Tan. In addition tests for size, chemistry, and morphology can be related to the ASCAT data.

Four members who had reached membership milestones were also recognized at the meeting: **Michael Alexander** and **Bob Wesolowski** (5 years); **Priya Manohar** (15 years); and **John Grubb** (LIFE).

January Meeting Summary:

(Continued from Page 8)

service—with an area of intergranular fracture at the origin and signs of fatigue for the remainder. The issue revolved around the sintering of a porous coating to the implant, which then allows the bone to adhere to after surgery. Near the melting temperature of the implant, the sintering caused grain boundary segregation. The grain boundary phase had low corrosion resistance to bodily fluids. The segregation also reduced fatigue strength. The process could be improved by doing the sintering before the hot isostatic pressing.

For an example of one that “didn’t go so well,” Mr. Hanke presented the case of a sculpture fabricated from 304 stainless steel. Although the commission that purchased the sculpture wanted it to be maintenance free, the sculptor specified a dull finish, which left the surface open for atmospheric corrosion (it was located a few blocks from the discharge of a steam plant burning wood refuse). A city “expert” deemed the corrosion “iron contamination” although the fabricators had no carbon steel in their shop and lab tests on the sculpture metal revealed no traces of iron; the artist called it a “patina.” In the end, an “expert” recommended a pickle and passivate and the other parties signed off on it to be released from further litigation. Today, pickled and passivated, the sculpture still stands, corroding.

In a final case, Mr. Hanke pointed out that, “It’s not just a game for lawyers to make money—there is a value to society. If we do our job right, the system works most of the time.” Metallurgically, it was a simple case of fracture, the huge striations a result of repeated stretching of copper gas supply pipes for radiant heaters. These had been responsible for several explosions and had been improperly installed by the same contractor. Mr. Hanke’s work, along with a fire investigator, resulted in changes to the NFPA Fuel Gas Code.



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Call for Volunteers

We are requesting ASM Pittsburgh Chapter members, representatives of Pittsburgh Chapters' sustaining member companies, students & faculty members of the local universities to come forward as soon as they can and join the chapters' executive committee. The volunteers are a key factor in the success and longevity of this materials society! We need your support and involvement to serve this professional community. There are many committee chair positions as yet unfulfilled this year. You can help in any capacity, small or large, that you feel you are interested in. For example you could help:

- develop, test and deliver educational products and services such as individual or company-wide
- training programs that provide opportunities for professional development / continuing
- education of members
- organize seminar series on topics of interest to the members to deepen their technical expertise
- to grow and retain membership
- to improve communications with membership
- foster the development of excellence in technical areas
- suggest topics and speakers for regular monthly meetings
- reach out to the local high school students and introduce them to materials science and engineering
- organize plant tours
- elicit applications for college scholarships
- act as judges in Pittsburgh Regional Science and Engineering Fair (PRSEF), volunteer for National Engineers Week and Materials Minicamps

There is certainly a value in being a volunteer. The regular monthly meetings are a wonderful resource to increase your professional network, broaden your horizons and stay current in technical knowledge. You also receive professional development points. Employers usually view these activities as a hallmark of high-achieving employees. This is also a great opportunity to hone your leadership skills! Hope you will join the ASM Pittsburgh Chapter executive committee in the near future. Thank you!

ASM Pittsburgh Chapter — Chapter Officers 2017-2018			
Chair	Nate Eisinger	Secretary	Markus Chmielus
Vice Chair	Piyamane Komolwit	Treasurer	Allan Hutt
Communications	Brian McTiernan		
Executive Committee Chairs (2017-2018)			
Auditing	Tom Joseph	Nominating	Nathan Eisinger
Awards	Joe Muha	Publicity / Public Relations	OPEN
Chapter Strategy / Long Range Planning	Dharma Maddala	Regular Meetings	Piyamane Komolwit
Education	Priya Manohar	Student Awareness	Parag Bedekar
Financial Committee	Allan Hutt	Student Development / Student Affairs	Markus Chmielus
Materials Engineering Institute (MEI)	Priya Manohar	Sustaining Members	Markus Chmielus
Membership Expansion	Dharma Maddala	Web Administrator	Stephen Rooney
Membership Records	Markus Chmielus	Yearbook	OPEN
Newsletter	Betsy Clark	Young Members' Night	Anil Chikkam

A Look Back...

As we approach 100 years of the Pittsburgh Chapter, we will be sharing with you fun and interesting stories from the history of our chapter as a way to celebrate this momentous occasion!

Typically the Pittsburgh Chapter Chair becomes the Chair of Chapter Strategy and Long Range Planning after their tenure as chair. In the 1973-74 year, this position was held by Mr. Samuel Manganello. Mr. Manganello started an initiative to encourage recycling of materials. Under his guidance, the Pittsburgh Chapter funded the production and distribution of 6,000 red, white, and blue bumper stickers that read “Always Salvage Materials” with “American Society of Metals” printed below. Mr. Manganello also reached out to the Pennsylvania Society for Professional Engineers, who then produced their own bumper stickers, “Please Save Precious Energy” with “PA Society for Professional Engineers”.

These early efforts to encourage recycling and energy conservation were even featured in an article in the Pittsburgh Post-Gazette on January 27, 1974. According to the article, this campaign was meant to encourage recycling of paper, aluminum cans, glass, cardboard, and plastics—materials that many of us now toss in a recycling bin without another thought today!



Mr. Samuel Manganello, Past Chair of the Pittsburgh Chapter, posted signs to encourage recycling of materials.

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April Meeting Summary

April saw another packed house at Lombardo's Restaurant in Bloomfield for the **Andrew Carnegie Lecture**, delivered by **Dr. Men G. Chu, FASM**, of Arconic Technology Center (formerly Alcoa), the 2100-acre facility near New Kensington. Dr. Chu was designated a Fellow of ASM in 1997 and is well-known in the industry, holding 21 patents and authoring 45 peer-reviewed journal articles. Dr. Chu earned his Sc.D. in Metallurgy from MIT, his M.S. in Material Science and Engineering from SUNY—Stonybrook, and his B. Eng. From National Cheng Kung University in Taiwan.

Dr. Chu explained the methodology he uses at Arconic to address ingot recovery issues and improvement opportunities at the ingot plant, which uses a direct chill (DC) ingot casting process. Each question starts with gaining a fundamental understanding of root causes—either at process or bench scale. Then computer simulation is used to generate possible solutions. Finally, casting trials are conducted to validate the findings. Dr. Chu illustrated a few success stories.

Surface oxide folding on high magnesium alloys was addressed with a bench scale immersion test that revealed how the oxide skim could be dragged from the surface down the side of the ingot mold. Computer modeling showed a strong convective flow, so the solution was to place an insulating ceramic insert into the mold (the “flow control mold”) that effectively pushed the solidification lower in the mold, thus avoiding the oxide folding. This was validated on 5xxx-series alloy.

Another challenge involved cracking of high-strength aluminum alloy ingots, usually at the quarter point. As Dr. Chu noted, there is not a lot of information in the literature regarding the measurement of mechanical properties in the freezing range for these alloys. Thus, they built an apparatus with a tensile specimen housed in a radial furnace, then



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applied the load at four temperatures, to generate stress-strain curves for a 7xxx-series alloy. Computer simulation then helped to determine that, if 25% less water was used for the ingot cooling, the plastic strain would decrease and the ingot would be crack-free.

Negative segregation of the ingot center for 2xxx-series alloys was another issue that Dr. Chu discussed. While reducing the convective flow in the liquid could resolve many of the segregation problems, a significant amount of capital would be required to convert to level pouring from the existing bi-level pouring. As an alternative, metal distribution bags at the spout were trialed, to disperse the liquid aluminum and reduce the convective flow.

Dr. Chu concluded with a look at

methods to achieve uniform or engineered composition of the ingots. Planar solidification, with the ingot poured on axis that resembles a book laying on its back cover, produced a flat solidification front with a low velocity. The trial was performed with a 90" x 45" x 25" monolithic Al-Zn-Cu-MG alloy. On the other hand, a variable pour (which does require two furnaces, one for each alloy) can create an engineered composition by pouring one grade on top of another before the first fully solidifies. For a 3xxx/6xxx ingot, the transition zone was only five centimeters thick.

At the April meeting, the Chapter also recognized **Paul Mason, President of Thermo-Calc Software**, for 15 years with ASM International. Thermo-Calc Software is a Sustaining Member of the Pittsburgh Chapter.



ASM Pittsburgh Chapter Chair Nate Eisinger expresses appreciation to April speaker, Dr. Men G. Chu for his presentation on casting of Al alloys.

April Meeting Summary: Heat Treat Society

Thomas Wingens, of WINGENS International Industry Consultancy (Pittsburgh and Stuttgart, Germany), opened the evening with a short presentation on the Heat Treating Society (HTS), affiliate of ASM International, and of which he is a board member. Mr. Wingens has 30 years experience in thermal processing and is internationally recognized. Thermal processing has had a long history with ASM, the organization originally being founded as the Steel Treating Club in 1913 in Detroit, Michigan. HTS was established in 1994.

Mr. Wingens noted that some manufacturers actually view heat treating as a nuisance. If so, they fail to recognize the full potential of the alloys they use, as strength can often be increased while simultaneously reducing weight. Heat treating generates \$15 billion per

year, adding approximately 10% of the value to the parts involved. He cited an example of gears for General Motors where the heat treating is so precisely controlled that grinding is not necessary. Mr. Wingens related heat treating to baking—it doesn't matter how good the dough is if it is baked incorrectly.

One very interesting part of his presentation contrasted images of a modern vacuum atmosphere heat treating facility with that of his grandfather's open air heat treating facility in Essen, Germany, some 70 years earlier.



ASM Pittsburgh Chapter Chair Nate Eisinger (right) with Thomas Wingens (left), board member of the ASM-affiliate Heat Treat Society

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The advertisement displays a variety of metallography equipment and supplies. On the left, there are two large white machines with red circular work surfaces. In the center, there is a white machine with a control panel and a black machine with a large viewing window. On the right, there is a white machine with a control panel and a black machine with a large viewing window. Below the equipment, there is a collection of various supplies including grinding wheels, polishing cloths, and bottles of cleaning solutions.



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