A Materials Technology Institute Publication

CONNECT

GLOBAL CHALLENGES / TRUSTED SOLUTIONS

2020, ISSUE 2

MTI Provides Ongoing Membership Value Amid Global Pandemic

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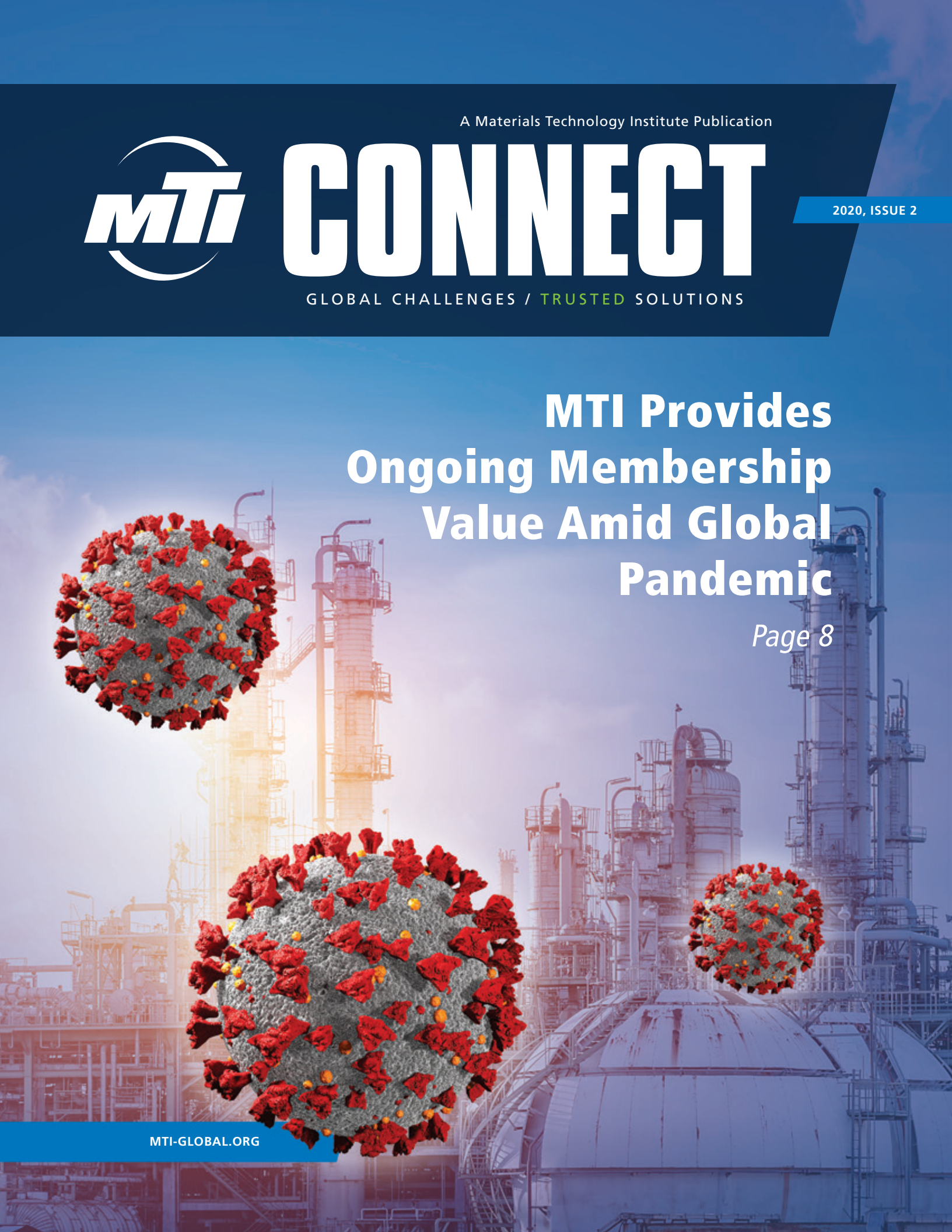

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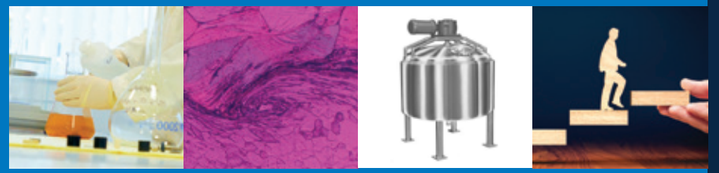

2020, ISSUE 2

ABOUT THIS PUBLICATION:

MTI CONNECT is published by the Materials Technology Institute, Inc. (MTI). MTI is a unique, cooperative research and development organization representing private industry. Its objective is to conduct generic, non-proprietary studies of a practical nature on the selection, design, fabrication, testing, inspection, and performance of materials and equipment used in the process industries.

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CALENDAR OF EVENTS:

AsiaTAC
September 16–17, 2020
Virtual Meeting

In-Service FRP Inspection Training
September 30–October 1, 2020
Virtual Meeting

Elastomer Training Course
October 26–27, 2020
Virtual Meeting

Global TAC Meeting
October 26–30, 2020
Virtual Meeting

AmeriTAC 134
February 22–24, 2021
Fort Lauderdale, FL

LETTER FROM THE CHAIR

2021 DUES DISCOUNT AND THE STATE OF MTI

The MTI Board of Directors acted in May 2020 to discount membership dues for 2021 by 10 percent. This action was taken in recognition of the impact of COVID-19 on many member organizations. The efforts of the MTI Staff and Board leadership in managing the budget have made this possible.

We've had to make the difficult decisions to cancel all face-to-face meetings in 2020. Yet, MTI is striving to continue providing ongoing value through virtual project development, training sessions and facilitating virtual TAC meetings. Project work is fully funded, and several large projects were wrapped up in the first half of this year. The dues discount will not impact the funding of new projects nor impede the progress of current projects. A new project on HTHA (Phase II – Performance of NDT, Simulations and Destructive Testing on Carbon Steel Samples Damaged by HTHA #355) was approved earlier this year. Two new projects were approved in June, including a Process Industry Corrosion Short Course (#336) and Fracture Toughness and Weldability of High Temperature Alloys (#356). Several potential projects were also formed during the virtual Global TAC Meeting in June, including a project to identify a new e-Library host (#363), SMR Cat Tubes: Strategies for Replacement (#365), and a Duplex Stainless Steels at Elevated Temperatures (#364) project that has global participation with co-champions from both EuroTAC and AmeriTAC.

MTI continues to offer excellent value through multiple online resources that are important to note. The TAC Forum and Information Exchange is experiencing an increased level of participation, webinar topics are being identified and offered as a benefit of membership, MTI is working to release a new online mentoring program, and virtual training programs, such as the upcoming In-Service FRP Inspection Training and the Elastomers Training, are crucial to the ongoing professional development of our members.

The Board sincerely appreciates your membership and participation in MTI and wants you to know that we recognize the financial and operational hardships caused by the pandemic. The discount on 2021 membership dues is an expression of our concern for you and your organization as we continue to manage our expenses while providing the services and value you expect from your MTI membership. ▪

Chair David Barber, Dow

MTI ADDS NEW PRODUCER AND NEW SUPPLIER TO MEMBERSHIP IN 2020

Two valuable new member companies joined MTI this year. Corteva and ArcelorMittal Industeel are now active in MTI's global technical community, participating in the online forum and contributing to project teams. These companies bring fresh perspectives and materials expertise to the organization. In this issue, we share information about their capabilities, reasons for joining, and interest in MTI activities.

Please be sure to connect with the new member representatives from Corteva (Ajit Mishra) and ArcelorMittal Industeel (Sandra Le Manchet) online and at future face-to-face meetings to welcome them to the MTI community.

Corteva Joins MTI Following DowDuPont™ Spinoff

The Corteva story began in 2015 when Dow and DuPont announced an agreement under which the companies planned to merge, then subsequently would spin off into three independent companies. Three years later, Corteva Agriscience, agriculture division of the DowDuPont™ brand, was unveiled. On June 1, 2019, Corteva became a standalone company and began pursuing MTI membership.

Coming from a background of membership with a previous member organization, Corteva Designated Representative Ajit Mishra, knew the importance of participating at MTI. "Before the spinoff, we were a part of DowDuPont™ and extensively benefitted by being an MTI member," explains Mishra. "So, it was not difficult to convince Corteva's current leadership to continue the MTI membership."

Corteva is a U.S.-based agriculture company with locations in more than 130 countries worldwide. The company works to provide farmers with the right mix of seeds, crop protection and digital solutions to maximize yields and improve their profitability, while strengthening customer relationships and ensuring an abundant food supply for a growing global population, according to the company website.

Mishra says one of the reasons for joining MTI is to bring awareness to materials issues in the agriculture industry and possibly find or provide solutions in these areas.

"We can assist the member companies in a better understanding of materials performance/selection in certain areas, which has not been extensively explored, like materials performance in organic compounds," Mishra explains.

Other reasons Corteva noted for joining are to make use of the valuable resources MTI offers, such as participating in projects, the TAC Forum and the e-Library.

"Our Materials Team utilizes most of the MTI resources on a frequent basis," Mishra observes. "For example, we refer to MTI handbooks quite often for materials selection guidance. Also, we closely follow (and participate) in TAC forum discussion to enhance our knowledge on materials.

"There are also multiple ongoing projects of interest to Corteva, like the Process Industry Corrosion Short Course. Some of the content from this project can be used to train our young engineers. The Corrosion in Bio-Oils project will be useful as most of our processes contain organic compounds, and there is a dearth of information on materials performance in organic compounds (or organic + inorganic chemicals). We anticipate that the information from this project can assist us in a better understanding of the subject matter," he adds.

As new members, Corteva hopes to continue participating in MTI activities and become more extensively involved in projects to assist the champion(s) in successful completion of the organization's project work.

"We are looking forward to contribute and work closely with member companies," Mishra concludes.

Stainless steel plates produced at the Industeel mill located in Le Creusot, France. Photo courtesy of Industeel

Industeel

ArcelorMittal Industeel Looks to Offer Corrosion Knowledge to MTI

Industeel, wholly owned by ArcelorMittal, is the direct inheritor of a long chain of steel companies who contributed in the making of steel history under different names through the years. The company produces carbon, low alloy, stainless steels and nickel-based alloys in a complete range of high-quality steel grades designed to meet customer specifications. With locations in 40 countries around the world, they serve customers in a variety of industries, including Oil & Gas, Chemical Process, and Fertilizers.

Interested in MTI's corrosion research and opportunities for networking, company Designated Representative (DR) Sandra Le Manchet, says they sought to join MTI as a supplier to seize the benefits as well as offer the company's knowledge of corrosion.

"We can contribute in several ways," Le Manchet explains, "By sharing our knowledge on stainless steel corrosion based on 50+ years of data, by performing tests in our laboratory (mechanical tests, corrosion tests, weldability tests), and by proposing development of new grades."

According to the new member DR, Industeel has a world class research facility for metallurgy with high-tech equipment and steel experts, especially in the field of corrosion. The team provides customers with

> CONTINUED ON PAGE 23

MTI VIRTUAL TRAINING PROGRAMS

In-Service FRP Inspection Training

September 30 – October 1 • WebEx Platform

Materials Technology Institute (MTI) is sponsoring a two-day virtual training program, September 30 – October 1, 2020 (six hours each day), on Inspection of In-Service FRP Equipment & Piping. This unique program will provide a comprehensive overview of the areas that are of critical importance for evaluating the quality and conformance of plant FRP equipment and piping, as well as providing some basis around Fitness for Service. The virtual program is intended for plant, engineering or materials personnel and inspectors seeking to improve their knowledge and understanding with respect to in-service FRP inspections. A team of practicing industrial subject matter experts (SMEs) will present topics in the following course outline:

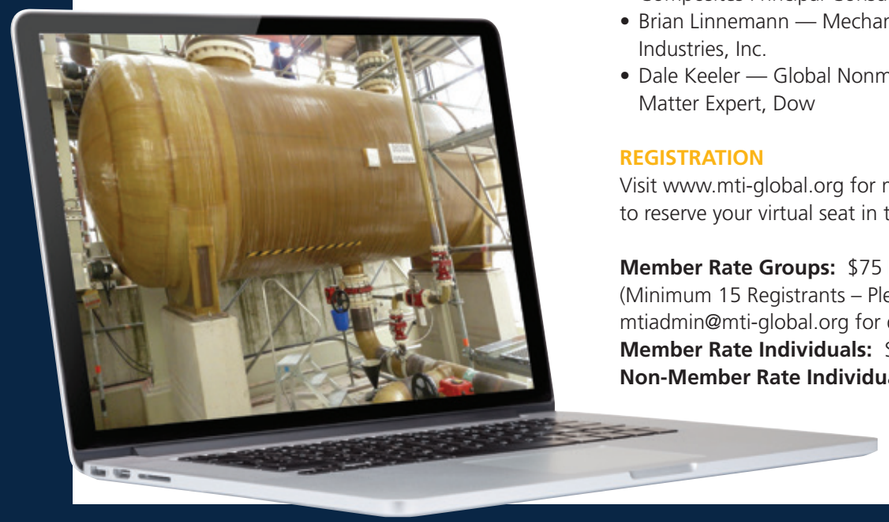
PROGRAM DAY 1:
- Introduction
- Materials Overview
- Design Overview
- Fabrication
- Quality Assurance
- Inspection Basics
- Visual In-Service Inspection Part 1

PROGRAM DAY 2:
- Visual In-Service Inspection Part 2
- NDE/Remote Visual Testing
- Destructive Testing
- FRP Repair/Alteration
- Fitness for Service
- Case Histories
- Comprehension Test (1 Hour)

MEETING START BY TIME ZONES

6:00 PM – Beijing, China
1:00 PM – Saudi Arabia
12:00 PM – Paris, France
6:00 AM – U.S. Eastern

INSTRUCTORS AND SME PRESENTERS
- Pradip Khaladkar, MTI Associate Director & MTI Fellow — Plastics, Elastomers & Composites for Chemical Handlings
- Debra McCauley — Plastics, Elastomers and Composites Principal Consultant, Chemours
- Brian Linnemann — Mechanical Engineer, RL Industries, Inc.
- Dale Keeler — Global Nonmetallic Subject Matter Expert, Dow



REGISTRATION

Visit www.mti-global.org for more information or to reserve your virtual seat in the training program.

Member Rate Groups: $75 Per Person
(Minimum 15 Registrants – Please email mtiadmin@mti-global.org for details.)
Member Rate Individuals: $100 Per Person
Non-Member Rate Individuals: $250 Per Person

Elastomers Training Course

October 26-27, 2020 • 9:00 AM – 2:00 PM EDT (each day) • Zoom Platform

MTI is offering a two-day Elastomer Training Course, October 26-27, 2020, open to members and non-members in conjunction with the virtual MTI Global TAC meeting. This course features a basic overview of elastomeric materials and detailed sessions on elastomer application specific to the Chemical Process Industry (CPI) presented by elastomer manufacturers/suppliers, end users and MTI staff. Several case studies will be presented by MTI members with extensive elastomeric materials experience.

COURSE CURRICULUM:

1. **Elastomer Basics – Pradip Khaladkar, MTI**
   - Fundamentals of Elastomers in the CPI
   - Elastomer Properties, Chemical Resistance, and Testing
2. **Fluoroelastomers, Pt. I (FKM) – Christopher Grant, Chemours**
   - Fundamentals of FKM Fluoroelastomers (Manufacturing, Properties, and Applications)
3. **Fluoroelastomers, Pt. II (FFKM) – Andres Rodriguez, Dupont**
   - Fundamentals of FFKM Fluoroelastomers (Manufacturing, Properties, and Applications)
4. **Gaskets and Seals – Manufacturer's Perspective – Jerry Waterland and Tim Rice, VSP**
   - Gasket/Seal Design and Performance
   - Elastomeric Materials Supply Chain
   - Specifying/Sourcing Elastomers for Gaskets and Seals
5. **Gaskets and Seals – MTI Member Perspectives**
   - Multiple MTI Member Presentations Summarizing Elastomer-related Experience
6. **Elastomer Lined Equipment – Mike Parsons and Danny Lee, Blair Rubber**
   - Choosing, Specifying, and Installing Elastomer Linings
   - Elastomer-lined Equipment Inspection, Repair, and Fitness for Service
7. **Elastomeric Expansion Joints – Derek Hicks, Garlock**
   - Design, Specifying, Manufacturing, and Inspection of Elastomeric Expansion Joints

REGISTRATION

Visit www.mti-global.org for more information or to reserve your virtual seat in the training program.

Members: Included with membership
Non-Members: $250

Course materials will be provided to Elastomer Training Course attendees prior to the event.

MTI Provides Ongoing Membership Value Amid Global Pandemic

VIRTUAL MEETINGS, PROJECTS, WEBINARS AND 24/7 MEMBER RESOURCES HELP MEET MEMBER NEEDS

The beginning of 2020 was a promising start to the year for MTI with the successful launch of its Global Solutions Symposium in February. The Symposium provided multiple opportunities for member and guest producers and suppliers to learn, network and engage to gain value. Unfortunately, the world was unprepared for what was coming after the onset of COVID-19 across the globe, shortly after the meeting for many. New regulations and social distancing to slow the spread of the virus caused businesses to take a new approach of working remotely or to shut down altogether. MTI, however, has consistently been in a position to continue offering member resources without significant disruption. While the format might be different than what many members are accustomed to, the impact of the virus has allowed MTI to reach deeper into its member organizations around the world to share knowledge, increase participation and provide ongoing value.

Virtual Global TAC Meeting Leads to Increased Participation

When leadership announced the face-to-face meetings were canceled, the AmeriTAC Chair and Vice Chair immediately began working to develop a virtual event for the June AmeriTAC meeting in order to continue MTI project work and offer learning opportunities through structured forum presentations. EuroTAC expressed interest in participating in order to continue their project development as well. A Global Virtual TAC Meeting was formed as a result, in which MTI invited all members around the world to join in. The virtual format and offering the event as a benefit of membership allowed for more flexibility. Registration spiked from the typical June AmeriTAC registration, which is usually 100 attendees or fewer, to 242 registrants who attended multiple project meetings.

The virtual meeting included three technical structured forums to provide educational opportunities to members: 1) Unique Ceramic Coating Technology for Refinery and Petrochemical Applications – 75 attendees 2) Microbiologically Influenced Corrosion: Susceptibility of Diesel Storage Tanks – 79 attendees 3) On-line Corrosion Monitoring – 82 attendees. (Presentations are available in the AmeriTAC community library at www.mti-global.org.) Most of the scheduled project team meetings for the event also saw a significant influx of attendees compared to a face-to-face meeting. The room capacity is typically 30 attendees during an in-person AmeriTAC meeting, but for this virtual event average attendance across the 21 project meetings was 47. Four project meetings hosted more than 70 attendees, one of which was a EuroTAC project, and only four project team meetings had fewer than 30 attendees join. The top five project teams attended include:

- High Temperature Low Chloride Pitting, Crevice Corrosion and SCC (Project 358) – 78 attendees

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- Metals Project Development Committee – 78 attendees
- HTHA Simulation Model Enrichment (Project 362 – EuroTAC) – 73 attendees
- Microbiological Corrosion (Project 301) – 72 attendees
- Process Industries Corrosion Short Course (Project) – 68 attendees

As a measure of the global participation among members, registrants included individuals from 53 member companies from 22 countries. EuroTAC attendees alone included 54 participants from 10 countries at the virtual meeting.

Not only did overall participation increase significantly for the joint virtual TAC meeting, but first-time MTI event attendees rocketed to 99 members from 27 companies and 19 countries. Furthering MTI's reach into member companies to garner involvement from those who can't typically attend was an important aspect of hosting the virtual event.

MTI Projects Continue Moving Forward

Ongoing involvement in MTI projects means more input and the ability to mold each project to fit member needs and create awareness around the value of each project.

"The June digital TAC meetings provided the opportunity for global collaboration and research on problems that would otherwise persist," notes Andrew Rentsch, Huntsman Designated Representative.

"Global TAC meetings also allow our company to learn from, shape, and propose potential MTI-funded projects."

Fifteen project teams and six Project Development Committees (PDCs) met during the virtual Global TAC Meeting. Two new projects were approved for funding, champions volunteered to form three potential projects, and several project concepts were developed during the PDC meetings. MTI's commitment to project progress is steady and the organization has not let the unsettled situation around the world due to COVID-19 impact one of the most valuable components of MTI membership.

The table on page 11 introduces the newly funded projects, as well as the potential projects from the virtual Global TAC Meeting. Visit www.mti-global.org/communitites to join these and other MTI project teams.

Webinars Provide Online Learning Opportunities

MTI launched its webinar program as an additional source of learning in the months between MTI's regularly scheduled Technical Advisory Council (TAC) meetings two years ago before the pandemic ever hit. The programs held to-date have proven to be a valuable resource for members during the pandemic, and MTI has seen regular member participation over the last year of successfully completing 12 webinars as of August 2020.

"Webinars provide value to Huntsman by offering technical training and best practices to our organization," observes Rentsch. "Webinars developed by renowned experts through MTI spares Huntsman from devoting resources on developing content internally."

The most recent event, Welding Metallurgy of Duplex Stainless Steels, presented by Ravi Vishnu (Outokumpu) on August 26, was an MTI record-breaking webinar sign-up of 262 registrants (249 members and 13 non-members). It was also the highest attendance of any MTI webinar with 208 of the registrants joining to participate. Prior to this event the highest participation was

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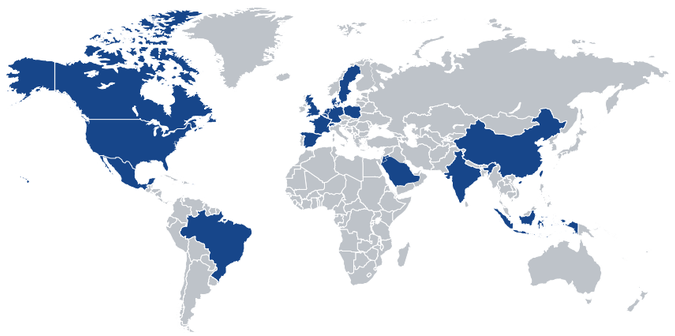
Global Virtual TAC Participation by Country



United States – 137
United Kingdom – 4
Taiwan – 2
Switzerland – 1
Sweden – 3
Spain – 2
Singapore – 4
Saudi Arabia – 2
Puerto Rico – 1
Poland – 1
Netherlands – 19
Mexico – 1
Jordan – 3
Indonesia – 1
India – 8
Germany – 12
France – 7
Denmark – 2
China – 2
Canada – 14
Brazil – 1
Belgium – 2

"We have slightly fewer attendees, but from a similar number of countries at a face-to-face EuroTAC meeting," remarks Anette Hansson (Haldor Topsoe), EuroTAC Chair.

"Having a virtual meeting is of course less costly in terms of man hours and travel expenses, thus allowing more people from the same company to join. However, I think that the main benefit is that the meeting is cross-global, which gives a global awareness of ongoing and potential MTI projects to engage members."

MTI Project Update Report

Virtual Global TAC Meeting (June 2020)

Project	Status	Summary
Process Industry Corrosion Short Course (#336)	Funded – $115,000	The goal of this project is to provide a course that will help fill the gap that exists for specific practical plant corrosion issues faced by engineers in the chemical process industry. To do this, course materials which can be used to facilitate training of entry level engineers and technicians, with a focus on corrosion and inspection fundamentals common to chemical process equipment, will be created. The course will incorporate a basic introduction to vessels, heat exchangers, columns, reactors, piping, and other common process equipment. Metallic and non-metallic materials of construction will be discussed. The various modes of corrosion damage specific to these systems including the inspection of equipment and possible remedies will also be addressed.
Fracture Toughness of High Temperature Alloys (20Cr-32Ni-Nb) (#356)	Funded – $28,000	Industrial users of high temperature alloys, in particular 20Cr-32Ni-1Nb, are interested in improved remaining life prediction approaches. In this project, a literature search with critical analysis by a technical expert will be completed for the potential use of high-temperature fracture toughness testing data for use in Fitness For Service (FFS) calculations for Steam Methane Reformer (SMR) outlet manifolds. The typical situation where this need arises is when an inspection on an aged reformer manifold reveals indications of creep cracking, or other forms of embrittlement, and a remaining life estimate of the manifold is required to plan for repair or replacement. However, due to the variety of testing techniques available, the MTI project team has decided a literature review of the state of the art in fracture toughness testing, especially at high temperature, is necessary before beginning a lab testing program.
MTI e-Library and Search Engine for MTI Documents (#363)	Potential	In 2016, MTI established a comprehensive, searchable electronic library containing MTI's documents, publications and other MTI technical information, including the TAC forum. The e-Library has been a high traffic area of the website, allowing members to instantly search for and access MTI's knowledge base. GVPi is the contractor who developed and hosts the library and they will cease providing this service by the end of 2021. MTI is looking for a vendor to provide a replacement for this e-library.
Duplex Stainless Steels at Elevated Temperatures (#363)	Potential	Following project 307, which was a thorough literature search on the topic of Duplex Stainless Steels (DSS) at elevated temperatures for short term exposures, this project was formed to fill in some of the gaps in knowledge of the effect on mechanical properties of DSS after repeated exposures, as well as the order of the aging exposures. A series of exposures will be conducted, and mechanical properties tested and compared to draw conclusions of the ability of these alloys to withstand short term exposure above recommended temperatures.
SMR Cat Tubes: "Strategies for Replacement" Survey (#365)	Potential	The overall reliability of ammonia, methanol and hydrogen plants is directly linked to the reliability of the steam reformer (SMR) units in the plant. The cost of reformers is a substantial investment for the entire plant. In addition to downtime production losses, SMR catalyst tube failures may result in significant safety risks and replacement costs. To maintain plant production and avoid unplanned shutdowns and production losses, an effective integrity management program for the catalyst tubes used in the SMR is critical. The objective of this project is to design, conduct and share a survey of the SMR integrity management programs used by member companies to understand practical, effective management options and potentially define best practices.

70 attendees for the PTFE Bellows in Chemical Plants webinar with Michael Bruemmer (Corrosion Resistant Products) in April 2020, and in 2019, 67 attendees for Introduction to Explosion Cladding presented by Steve Sparkowich (NobelClad) was a close second. Just for comparison, the average participation of the eight webinars in 2019 was 47 attendees.

TAC Forum Activity

As veteran MTI members know and new members soon find out, the MTI TAC Forum is a 24/7 online discussion for members only. It is regarded as one of the most valuable member benefits at MTI due to rapid and authoritative responses from other materials experts and knowledgeable members. At the beginning of the pandemic, we heard several comments from members that it seemed like TAC Forum activity skyrocketed. However, that's not the case.

The MTI website committee regularly monitors the TAC Forum and it fluctuates every year. It all depends on member issues and questions within their company seeking guidance or expertise from month to month. The TAC Forum Use Comparison graph demonstrates the fluctuation from the time COVID-19 hit in the U.S. in 2020 compared to last year. As you can see, each month is almost the exact opposite of high-use versus low-use, but it doesn't indicate any less value that members receive from posting questions and receiving multiple answers, ideas or solutions. The value is in the quality of responses and quick turnaround time it takes to get those answers!

Future Plans

The virus hasn't vanished and, unfortunately, MTI made the difficult decision to cancel all the Fall 2020 face-to-face meetings. Instead, the

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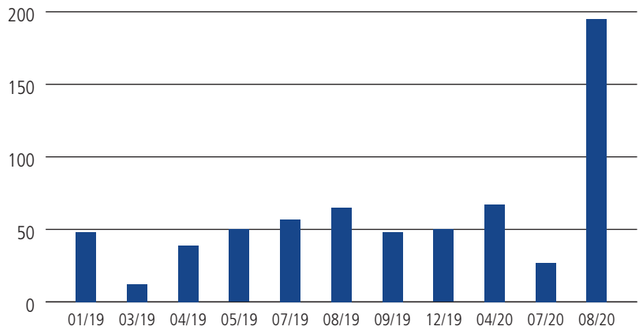
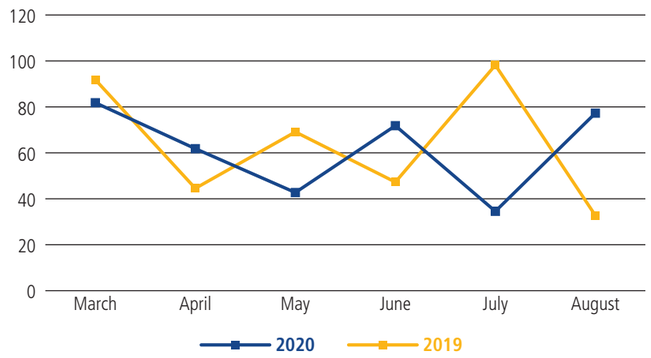
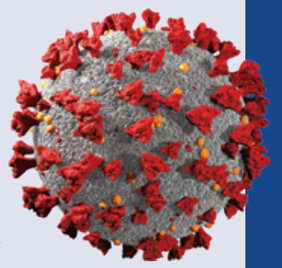
MTI Webinar Attendance Records
2019 – 2020



TAC Forum Use Comparison
2020 vs. 2019



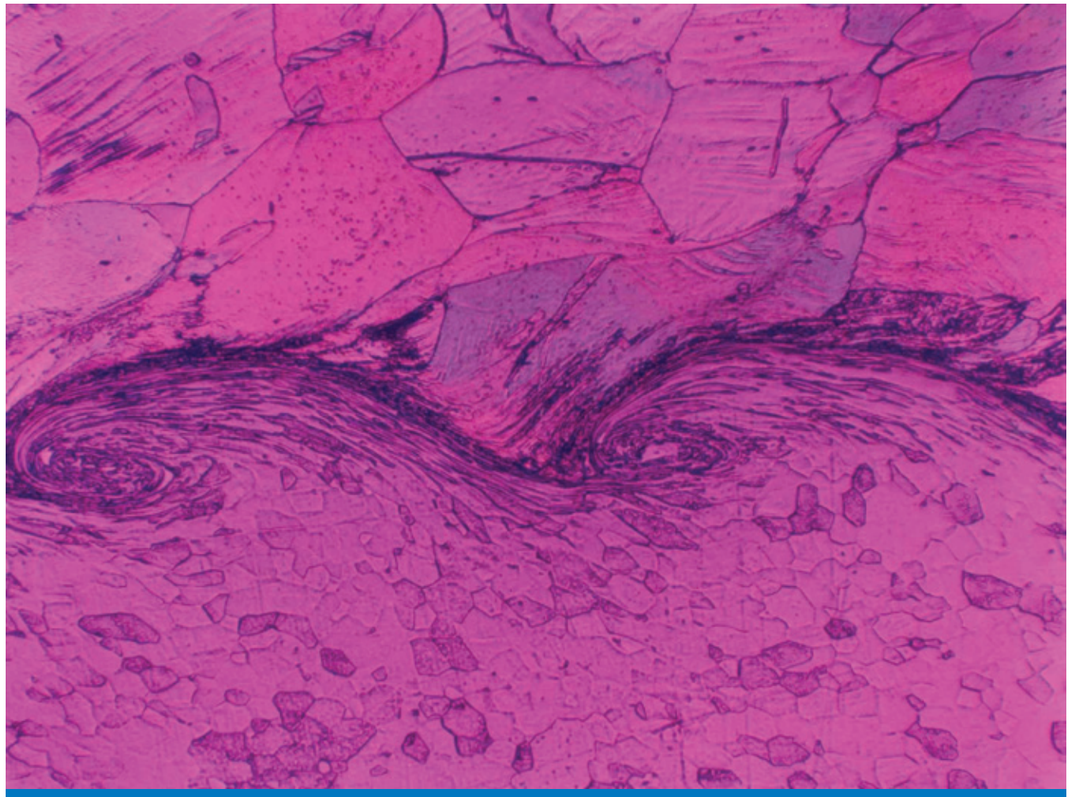
TAC Meetings Update



Due to the ongoing concerns for the health and safety of everyone as a result of COVID-19, the MTI Technical Advisory Councils (TACs) have opted to hold virtual meetings in Fall 2020.

AsiaTAC will meet for two days September 16-17, and AmeriTAC and EuroTAC will collaborate again for a Global TAC Meeting October 26-30. All members are invited to participate in both events, which will be included with membership at no additional charge.

For more information and registration, please visit www.mti-global.org.



Tantalum-Copper clad interface showing the wave pattern, which is typical of explosion clad. Photomicrograph courtesy of NobelClad.

REACTIVE AND REFRACTORY METALS BOOK PROJECT NEARING COMPLETION

MTI's Reactive and Refractory Metals Best Practices book project isn't quite complete yet, but it is already providing a glimpse of the value that it will deliver to members. Recently, a producer company representative contacted the project team looking for answers while researching a titanium fire that occurred while cutting the reactive metal during a maintenance procedure. The book's Safety Appendix, supported by additional input from the team, suggested the most likely cause for the failure and helped the company move to the next step in its investigation of the incident.

The new guidebook, which is planned to be released in the fourth quarter of 2020, includes sections on Titanium, Zirconium, Tantalum and Niobium, and Clad Metals, in addition to the Safety, Welding, Casting, and Project Management Appendixes. There is no other all-inclusive reactive and refractory metals reference like it in the world, and some of the information in the Clad Metals and other sections has never appeared in any format, including industry technical papers.

"As with all MTI publications, the contents are systematically arranged and each section is sequentially numbered for easy reference," notes Project Co-Champion Wendy McGowan (Neotiss). "In addition, the content has been enhanced with numerous photographs, tables, graphs and illustrations to help explain the many topics."

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Q&A

WITH JEREMY NELSON & JOSE RAMIREZ

PROJECT CHAMPIONS

MTI is at the forefront of providing global leadership in materials technology to improve safety, reliability, sustainability and profitability. Technical research projects play a vital part in the success of the MTI mission. While the goal and outcome of each project varies, the commonality is member leadership to develop and nurture each project from inception to completion. These member leaders, dubbed MTI Project Champions, have the unique opportunity to grow leadership skills, network and create tangible solutions alongside other industry professionals.

In this issue, CONNECT reached out to Jeremy Nelson (Koch Industries) and Jose Ramirez (Air Products & Chemicals) to learn more about their experiences with MTI and what to expect from the recently funded Project 356 – Fracture Toughness and Weldability of High Temperature Alloys.

Q: ***Tell us about yourself (company, role/what you do). When did you first begin participating in MTI?***

A: **NELSON:** I work for Koch Ag & Energy Solutions, LLC (KAES), which is a wholly owned subsidiary of Koch Industries, Inc. KAES is a global provider of value-added solutions (i.e. fertilizer) for the agriculture, turf and ornamental, energy and chemical markets. I am a Fixed Equipment Engineer in the Operations Excellence group at KAES. I work on equipment design, fabrication, maintenance and inspection issues. I began participating in MTI in 2016, when I was a corrosion and materials engineer at Flint Hills Resources, which is the fuels and petrochemicals subsidiary of Koch Industries, Inc.

A: **RAMIREZ:** I work for Air Products and Chemicals, Inc. as part of the Materials Engineering and Technology group. I have been involved with materials engineering and research for more than 30 years. My current emphasis is in high temperature application and welding technologies. I started participating in MTI activities around 2016.

Q: ***Briefly give the background of Project 356 – Fracture Toughness and Weldability of High Temperature Alloys. Why and how did it become an MTI project?***

A: **RAMIREZ & NELSON:** Due to service conditions, high temperature alloys including 2032Nb castings age and may experience creep damage. As a result, the fracture toughness and weldability of these materials and welded joints may decrease. MTI has a legacy of projects, which advanced the state of the art in understanding the changes these alloys undergo as they age. MTI has had a long-standing interest in assessing the remaining life of high temperature alloys, which are used in steam methane reformers, cracking furnaces, delayed cokers, and other processes. Project 356 intends to build on those projects by validating techniques for remaining life assessment in-situ, potentially including miniaturized samples that are relatable to full scale specimens.

Q: ***Why/How did you become champions of Project 356?***

A: **RAMIREZ & NELSON:** We volunteered to co-champion as we were preparing the Project Funding Summary. I [Nelson] proposed this project, because we both see an opportunity of improving the life assessment techniques for high temperature cast components. We would like to identify and combine those techniques for producing remaining life data with the understanding of mechanical property evolution that has been developed by the previous MTI projects.

These are techniques that can be used to manage the SMR furnaces in our respective businesses. By extension, we feel that all MTI member companies who operate furnaces in petrochemical processes will benefit from the results of this project.

Q: ***You are active participants in the TAC Forum, TAC Meetings and MTI Projects. How have your experiences of being involved in the various aspects of MTI helped you serve as the Project 356 Champion?***

A: **RAMIREZ & NELSON:** There is synergy formed by participating in various MTI activities. Every activity involves interacting with other companies' materials experts, shared technical questions, and discussing potential solutions or paths to a solution. In a nutshell, we as champions need to coordinate and/or lead those kinds of activities within a project.

Q: ***The project was funded during the virtual Global TAC Meeting in June 2020. What are the next steps for this project, what can we expect as the final product and what is the expected timeline for completion?***

A: **RAMIREZ & NELSON:** Our contractor is in the process of performing the literature review and seeking critical input from recognized experts in this domain (Carl Jaske in particular). The next step will be an October 2020 Global TAC project team meeting to go over the preliminary findings of that review. We expect the review to publish by the end of 2020. Our hope is that the review will point out the scope of a Phase II project focused on laboratory testing to validate the techniques and potentially develop industry practices or guidelines.

Q: ***What is the importance of the Fracture Toughness and Weldability of High Temperature Alloys project and how will it benefit members and the industry?***

A: **RAMIREZ:** Our goal is to come up with a high temperature component field portable assessment guideline that industry trusts enough to make asset management decisions.

A: **NELSON:** In other words, some day in the future, I would like to take the results of Project 356 as my direction for sampling and testing a manifold in one of my company's heaters to determine the timing of repair or replacement, similar to how we use the ASME/API 579 Fitness For Service codes for assessment of other components.

Q: ***What have you learned from serving as project champion? Do you have any advice for other MTI members who might consider volunteering as a champion?***

A: **RAMIREZ:** Being a project champion is a hands-on learning experience. By engaging in discussions with other peer experts, listening and channeling ideas, we reach common goals and manage the allocated resources to benefit MTI member companies.

A: **NELSON:** The champion role is like getting a graduate level education in a very practical topic for free. The advice provided by project team members and MTI Associate Directors is very valuable in helping support our own companies.

Q: ***What is your favorite component of MTI meetings (when we can meet in person, of course) and why?***

A: **NELSON:** The energy of the discussions we get into. I also like seeing hands-on stuff like we have had at some of the technical trainings and the RFID project closeout. We are trying to bring some of that hands-on content into the virtual Global TACs with our Technical Showcases coming up (via video of course).

A: **RAMIREZ:** I also enjoy the social interaction, which helps us appreciate our diversity, and sometimes gives us the chance to taste the local food and culture of a place in the country. ▪

Technical Awareness Bulletins (TAC Bulletins) published by MTI are brief industry-related topics that have universal and evergreen value. The TAC Bulletins Committee develops ideas to produce new bulletin topics that will have an impact on MTI members and the industry, as well as regularly reviews and revises past bulletins to keep them up to date with best practices and industry standards.

In this issue of CONNECT, MTI is releasing Bulletin No. 11 – Alloying Elements in Stainless Steel and Bulletin No. 27 – Polythionic Acid Stress Corrosion Cracking. Bulletins released to the public can be downloaded by visiting www.mti-global.org/participate/tac-bulletins.

Materials Technology Institute

Technical Awareness Bulletin

Alloying Elements in Stainless Steel | No. 11

Alloying Elements in Stainless Steel…. Effect on Properties and Cost

Stainless steel is iron alloyed to chromium with certain additional elements to give the required properties to the finished metal. Since many of these alloying elements are expensive, producers try to minimize cost by closely controlling the percentages of these alloying elements while maintaining the desired properties. Listed below is a summary of the effects of various alloying elements in steel.

Carbon

Carbon, in most situations, is an impurity in stainless steel, which is removed in the steelmaking process. It can impair corrosion resistance. Its presence, however, raises strength especially at elevated temperatures.

Manganese

Manganese is added to stainless steel to improve hot working properties. Manganese has been used as a substitute for nickel in the 200 series stainless steels (e.g., type 201 as a substitute for Type 304) to reduce cost.

Chromium

Stainless steel by definition has a minimum chromium content of 10.5%. This concentration of chromium provides stainless steel with its inherent corrosion resistance and particularly oxidation resistance. This resistance increases as more chromium is added to the stainless steel.

Polished Stainless Steel Vessel Typically Used in Food Processing and Pharmaceutical Manufacturing

Nickel

Nickel is added in large amounts, over about 8%, to form the most important class of corrosion and heat resistant stainless steels. These are the 300-series austenitic stainless steels, typified by Type 304, which has great toughness and high strength at both high and low temperatures. Nickel also increases toughness at low temperatures when added in smaller (1-3%) amounts to some stainless steels. Nickel is an expensive material and typically represents the costliest component of the material cost of stainless steels.

Molybdenum

Molybdenum, when added to stainless steels, improves resistance to pitting corrosion especially by chlorides and sulfur chemicals. Molybdenum is currently the most expensive alloying element on a per pound basis that is added in significant amounts.

Titanium

The main use of titanium as an alloying element in stainless steel is to combine with carbon to form titanium carbides. Titanium combines with carbon more readily than chromium. This prevents a tie-up of corrosion resisting chromium as intergranular carbides and the accompanying loss of corrosion resistance that often results in intergranular corrosion especially in weldments. Type 321 is an example where titanium is added as an alloying element.

Phosphorus

Phosphorus in stainless steels is an impurity which cannot be removed by practical refining techniques. The presence of phosphorous is known to increase the tendency to cracking during welding.

Sulfur

Sulfur is an impurity which decreases hot workability and corrosion resistance. Sulfur is removed by reaction with lime in the steelmaking furnace slag. When added in small amounts sulfur improves machinability and weld penetration.

Niobium (Columbium)

Niobium is added to stainless steel to stabilize carbon, and as such performs in the same way as described for titanium. Niobium also has the effect of strengthening steels and alloys for high temperature service. Niobium usually survives steelmaking melting and refining and its final concentration in the alloy is generally easier to control than titanium.

Nitrogen

Nitrogen has the same metallurgical effect as nickel. Yield strength is greatly increased when nitrogen is added to 300 series stainless steels. Nitrogen also improves corrosion resistance in 300 series and duplex stainless steels, but embrittles 400 series stainless steels.

Silicon

Silicon is used as a deoxidizing agent during melting, and most stainless steels contain a small percentage (less than 0.5%) of silicon. Silicon added at higher levels (3-6%) provides resistance to corrosion by nitric and concentrated sulfuric acids but this tends to reduce weldability and may lead to lower toughness.

Cobalt

Cobalt is present in small quantities in stainless steels used in the chemical industry. These small amounts have no effect on properties. Cobalt, however, does become highly radioactive when exposed to neutron radiation inside nuclear reactors. For this reason, stainless steel used in nuclear service may have a cobalt restriction, usually 0.1% maximum.

Copper

Copper is normally present in stainless steels as a residual element. However, it is added to a few alloys to produce precipitation hardening properties, and to a few other alloys to improve resistance to dilute acids.

Additional Information
ASM Handbook – Volume 3

Reviewed/Revised 2018

This report is subject to later revision. MTI assumes no responsibility for the contents or for results associated with implementing any recommendations.

Materials Technology Institute

Technical Awareness Bulletin

Polythionic Acid Stress Corrosion Cracking (PTA SCC) | No. 27

Background

Polythionic acids are a concern for refineries and petrochemical plants due to the extremely rapid intergranular stress corrosion cracking that can occur in equipment during shutdowns, startups or during operation when air and moisture are present. Often, the cracking is noticed upon plant start-up causing the plant to be brought down for additional repair, resulting in additional loss of production and repair cost. Cracking is usually located adjacent to welds or high stress areas and can be rapid: reports of penetration of 12 mm (1/2 inch) wall thickness in less than 8 hours exposure are in the literature. Issues may not be noticed until the plant restarts after the shutdown period. See **PHOTOS: A1 and A2** below of a severe case of polythionic acid stress corrosion cracking.

Polythionic acids are a group of weak sulfur bearing acids of the form H2SnO6, (such as sulfurous acid) where n is normally between 2 and 5. See Figure 1 for schematic of the polythionic acid molecule.

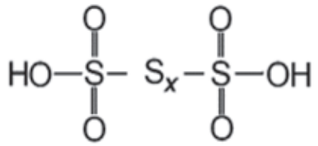


Figure 1: Polythionic Acid

During normal plant operation in refinery and petrochemical plants, a thin chromium or iron sulfide scale is formed on fixed equipment (rotating equipment has been reported on occasion as well) during exposure to the process stream, often hydrocarbon containing H2S, under reducing conditions. Upon exposure to air during a shutdown period, the sulfide scale oxidizes (decomposes) to polythionic acid by reaction with liquid water in the presence of oxygen.

8 FeS + 11 O2 + 2 H2O = 4 Fe2O3 + 2 H2S4O6 (tetrathionic acid)

Liquid water can be present simply due to dew point water condensing from air.

Conditions for Cracking to Occur

Three conditions are required:

- Susceptible microstructure (sensitized austenitic stainless steels 300 series, alloy 800/800H or nickel alloy such as 600/600H)
- Stress (residual or applied loads)
- Sulfide scale exposed to air, with liquid water present

Types of Equipment that Might be Affected

Any refinery or petrochemical equipment constructed of a susceptible material exposed to environments that contain a sulfur-bearing species in the process stream is susceptible to PTA SCC and at greatest risk during shutdown periods when the process fluid is removed and air is allowed to enter. Humidity in the air is sufficient to cause liquid water to condense at night when temperatures drop below the dew point. Hydrodesulfurizing units are the most common units in which PTA SCC may occur, although any equipment that contains H2S in the process stream is vulnerable. Heater tubes, heat exchanger tubes, piping and valves have also failed by this mechanism.

How to Avoid Polythionic Acid SCC

To mitigate the risk of PTA SCC, it is advised to remove any one of stress, susceptible microstructure or the environment. Stress is the most difficult to remove, because any residual stresses from forming or welding, or static loads on the equipment are sufficient to drive SCC. Removal of the susceptible microstructure depends on the degree of sensitization in the material. Stabilized austenitic stainless steels such as 321 and 347 or nickel alloys like 625 and 825 have improved resistance to PTA SCC. Low carbon grades such as 304L/316L/317L may also be an alternative, however, care must be taken because such stainless steels will sensitize if exposed for a few hours at 400 °C (750 °F).

The most common method of avoiding PTA SCC is to ensure that the sulfide corrosion products on the equipment do not come in contact with air or liquid water. These methods are codified in the NACE Recommended Practice RP-0170 “Protection of austenitic stainless steels and other austenitic alloys from polythionic acid stress corrosion cracking during shutdown of refinery equipment”. The methods concentrate on ensuring no contact with air and water (nitrogen purging or dry air purging) or neutralizing the acidic environment (alkaline or soda ash washing). Care must be taken if using either of these methods since there are risks associated with both. Nitrogen purging requires extreme care due to the dangers of inert gas vessel entry. Alkaline washing requires great care in rinsing the equipment of the soda ash solution and proper draining of all low points due to the risk of caustic embrittlement.

A second concern is the quality of the alkaline water solution, as chloride content must be carefully controlled so that chloride SCC does not result. An additional corollary concern is the downstream poisoning effect of sodium on catalysts.

Tests for Cracking Susceptibility

ASTM G35 outlines the standard testing that can be performed to determine material susceptibility and should be reviewed for relevance. Simulated solutions may be prepared in the laboratory to test sensitized materials against non-sensitized material. Polythionic Acid is generated in a laboratory environment by first bubbling SO2 through water, then bubbling H2S through the resulting sulfurous acid. Samples are stressed and placed in the solution and the time to failure recorded.

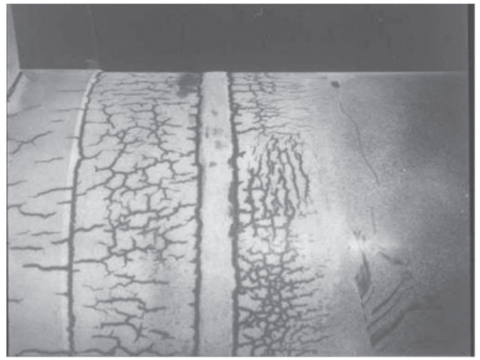


PHOTO A1: Dye Penetrant Inspection Showing Extensive Cracking around Welds

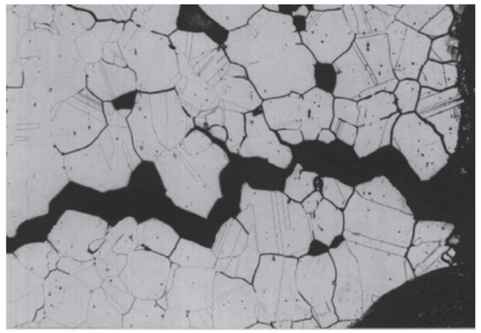


PHOTO A2: Polythionic Acid SCC of Austenitic Stainless Steel (~ 200X)

Reviewed/Revised 2019

MTI TO LAUNCH NEW ONLINE MENTORING PROGRAM FALL 2020

MENTOR MATCH PROVIDES OPPORTUNITY FOR MEMBERS TO ENGAGE WITH EXPERTS

Informal mentoring at MTI is a common occurrence among members. The MTI Mentor Match program is a unique online networking and knowledge development tool that will help members find, connect and share experiences with others. It is user-driven, allowing registered mentees to search among registered mentors using specified criteria to find individuals whose experience and expertise match areas in which they wish to be mentored. The best part—it's a benefit of membership, so there is no additional fee associated with the program. Members will simply be able to log in to their profiles and access the module from the main menu.

Connecting with experts through a more formal online process is a good opportunity for all members, especially now during the global pandemic when members can't network at face-to-face meetings, as well as for those who might not be able to attend in-person events throughout a typical year. In addition, members can participate in varying capacities. The amount of time and duration of a mentoring relationship will be dependent on the topic and the depth of understanding a member wishes to achieve. The mentor and the mentee will mutually agree on the amount of time to be devoted to the relationship, the method of communication and the duration.

How does mentor matching work?

Members must first enroll as a mentor, mentee or both. During the enrollment process, members will select preferences for various demographics to establish their personal criteria. The initial list of mentoring topics members can select from in order to sign up include:

- Ceramics
- Metals
- Polymers
- Knowledge Management
- MTI Champions
- DR/TAC Reps
- MTI Resources

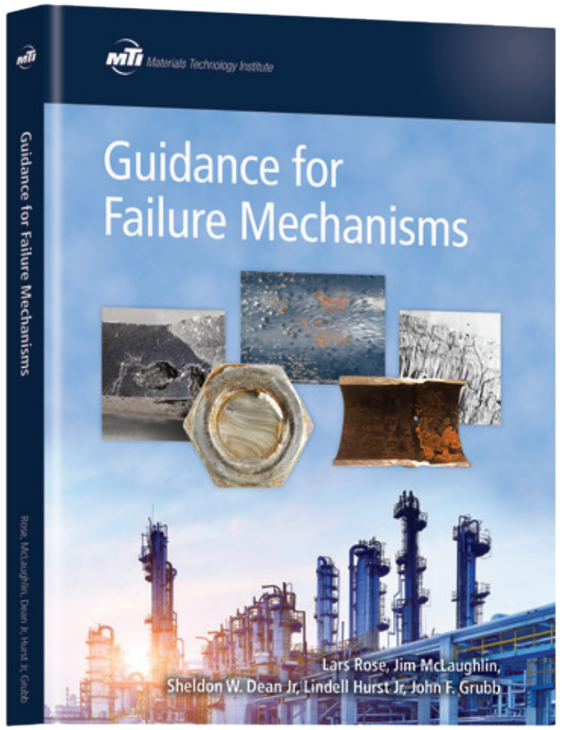
To complete the process, a registered mentee will visit the "Find a Mentor" page and fill in their search criteria to search for possible mentors. The mentee will click the names of the potential mentors to view their profiles. Once the mentee has decided on a mentor, they will click on the mentor badge (seen below the registered mentor's profile picture) to request that person as their mentor. An e-mail will be sent to the mentor alerting them that they have been requested to be a mentor. The mentor will be able to accept or decline the request.

Member participation is key to the success of the program and MTI may add additional mentoring topics as the program progresses. If you have any subjects that you are seeking a mentor in, but it's not on the list, you may submit your suggestions to mtiadmin@mti-global.org.

Be sure to watch for the announcement this fall to sign-up and participate on the MTI website! ▪

GUIDANCE FOR FAILURE MECHANISMS OFFERED TO MTI MEMBERS ONLY FOR A LIMITED TIME

AVAILABLE FOR PURCHASE IN THE MEMBER BOOKSTORE



MTI Project #268
Published June 2020
ISBN 978-1-57698-094-1
Authors: Lars Rose, Jim McLaughlin, Sheldon W. Dean Jr, Lindell Hurst Jr, John F. Grubb

The idea behind this book was to create a publication that would not simply copy existing documents—such as the API 571 and its supplemental documents (for example, API RP 941 and API RP 939-C); the 2016 Handbook of Materials Failure Analysis with Case Studies from the Oil and Gas Industry, edited by A. Makhlouf; or the MTI document 170-05 (Guidance for Plant Personnel in Gathering Data and Samples for Materials Failure Analysis by David E. Hendrix)—but extend the content beyond these volumes and (because many failures may occur at very different industries) to make the topic of failure mechanisms more relevant to the chemical, pharmaceutical, and food processing industries.

This idea was discussed among the MTI EuroTAC members during the 2012 and 2013 EuroTAC meetings in Frankfurt, Germany. The first proposal to generate a project out of these discussions was floated during the 2014 EuroTAC meeting at Aachen University, with Dr. Lars Rose of DuPont as the project champion, Heather Allain and Patrice Houlle (MTI) as the project managers, and with the support of a number of MTI member companies. Over the course of two years, several global Technical Advisory Councils (TACs) and a slew of phone conferences, a very diverse project team had assembled to fit what could be dozens if not hundreds of individual scientific books on each failure mechanism into one single volume of 31 chapters. Furthermore, the final product aims to be sufficiently interesting for doctoral materials engineers to read yet comprehensible and concise enough to be given to any newly appointed field inspector to identify failures in the field and learn how to prevent said failures, thereby improving the overall quality of inspections and, ultimately, reducing the incident and failure rate in the field. Or, in other words, to achieve the perfect solution to the multitude of interests represented.

The result will hopefully be useful to and used by companies as one of the main go-to tools in materials inspection and selection. Once released to the public, it may be used as a guide to failure mechanisms for all petrochemical, chemical, pharmaceutical, and food industries. Although it is not comprehensive, it is meant to supplement the currently available mechanisms available in API 571 and point the reader to other helpful documents and references for greater depth than can be covered here. ▪

Cost

$95.00 per Book

How to Purchase

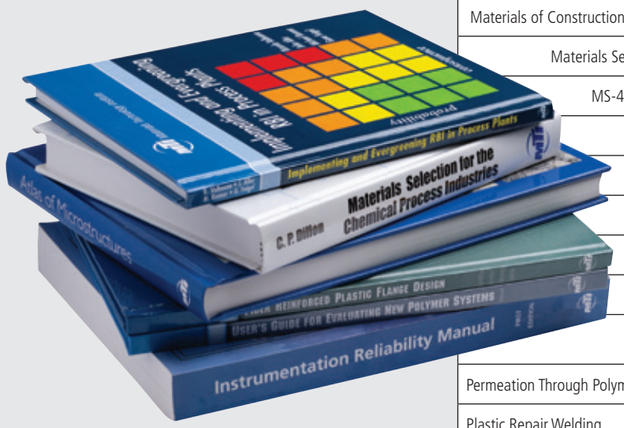
Please Visit https://www.mti-global.org/participate and Login for Member Bookstore Access

MTI MEMBER BOOKSTORE – SPECIAL, MEMBER-ONLY BOOK SALE

The MTI Board of Directors approved a publication inventory sale to reduce the number of copies of MTI books in our warehouse. Most of the available publications are offered at the minimum warehouse handling fee and a few others are significantly reduced from the regular member price.

Take advantage of this opportunity while it lasts. Please see the table for the list of publications and prices included in the inventory reduction offer.

There is no limit to the number of publications an individual member may purchase; however, there may be limited quantities available for certain publications and all orders are subject to shipping fees. This offer is available to current MTI members—first come first serve, and publications in this offer are only available through the MTI Member Bookstore. Please login and visit www.mti-global.org/participate to access the bookstore for this amazing deal. ▪



MTI Publication Inventory Reduction 2020

Publication Title	Sale Price	Regular Price
Addendum to Cleaning of Process Equipment & Piping	$2.00	$30.00
Atlas of Microstructures	$150.00	$325.00
Atlas of Microstructures II	$150.00	$315.00
Carburization: A High Temperature Corrosion Phenomenon	$2.00	$25.00
Corrosion Testing of Iron & Nickel Based Alloys Part 1	$2.00	$20.00
Corrosion Testing of Iron & Nickel Based Alloys Part 2	$2.00	$20.00
Damage Assessment: Investigating Fires, E xplosions & Storm Damage in Chemical Plants	$75.00	$212.00
Design, Installation, Maintenance & Inspection of Metallic Plastic-Lined Pipe	$2.00	$20.00
Evaluation of Tantalum Welds	$2.00	$46.00
Fiber Reinforced Plastic Flange Design	$50.00	$250.00
Guidance for Plant Personnel in Gathering Data & Samples	$2.00	$125.00
Guidelines for Large Diameter FRP Tanks	$2.00	$68.00
Guidelines for Troubleshooting Water Cooled Heat Exchangers	$2.00	$125.00
Hydride Formation in Alpha Titanium & Titanium Alloys	$2.00	$212.00
Implementing & Evergreening RBI in Process Plants	$2.00	$120.00
Instrumentation & Reliability Manual	$50.00	$325.00
Laboratory Corrosion Testing of Metals & Alloys	$2.00	$125.00
Limitations of the Slow Strain Rate Test	$2.00	$25.00
Materials of Construction for Once Through Water Systems	$2.00	$23.00
Materials Selection for the Chemical Process Industries	$75.00	$125.00
MS-4: Hydrogen Fluoride & Hydrofluoric Acid	$18.00	$75.00
MS-5: Nitric Acid s	$18.00	$75.00
MS-6: Ammonia & Caustic Soda	$18.00	$75.00
MS-7: Phosphoric Acid	$18.00	$75.00
MS-8: Organic Solventsa	$18.00	$75.00
MTI Second International Symposium	$2.00	$28.00
Operation Maintenance & Repair of Glass-Lined Equipment	$2.00	$125.00
Permeation Through Polymers (2nd Edition)	$2.00	$25.00
Plastic Repair Welding	$2.00	$18.00
Reliability Guidelines for Flexible Hoses	$2.00	$18.00
User's Guide for Evaluating New Polymer Systems	$2.00	$140.00

MTI ADDS NEW PRODUCER AND NEW SUPPLIER TO MEMBERSHIP IN 2020

> CONTINUED FROM PAGE 5

in-field technical assistance to help gain full advantage of their grades. They also provide solutions in terms of heat treatment, welding, cutting and forming recommendations, and other specific technical issues such as corrosion testing. The company's engineers can also design new solutions to respond to specific market requirements with innovative products and/or processing methods.

"For instance, we have been working on materials recommendation for the chemical and fertilizers industry for several years," Le Manchet remarks. "In addition, we have a strong expertise on H2S corrosion and can run tests under pressure / temperature. Finally, we have a welding shop and welding experts. We can bring our experience on weldability (hot cracking, cold cracking, welding processes) to the MTI members."

Immediately after becoming members they started using MTI resources and participating by attending the Global Solutions Symposium in February.

"This event allowed us to build new contacts, especially in the Oil & Gas and Chemical Industry within the members," she observes.

Industeel performs corrosion testing in their labs as one of the many industry solutions the company offers. Photo courtesy of Industeel.

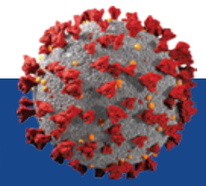
"It was also an excellent opportunity to understand the materials issues faced by these industries. Unfortunately, the other events have been cancelled due to the COVID situation."

Despite the face-to-face event cancellations, the company has taken an interest in several current MTI projects and been able to follow and participate in these developments virtually.

"We are very interested by MTI projects," Le Manchet notes. "For example, Stress Relaxation Mitigation Strategy is a topic on which we have been working these last three years, and we would be happy to share our knowledge with the MTI members."

In wrapping up, Le Manchet says Industeel plans to continue participating within the projects, networking to learn and share knowledge, and continue gaining value from MTI membership.

Welcome Corteva and Arcelor-Mittal Industeel! Thank you both for your participation in your first year and we look forward to your continued membership. ▪



MTI PROVIDES ONGOING MEMBERSHIP VALUE AMID GLOBAL PANDEMIC

> CONTINUED FROM PAGE 12

organization with hold virtual TAC Meetings in place of those events to continue project work, provide training opportunities and facilitate technical learning and discussion.

"The upcoming meeting contains many sessions on ongoing or potential projects that may enlighten you and bring value to your company. By participating you can influence the direction on the potential projects," explains Hansson, who has been collaborating with the AmeriTAC Chair and Vice Chair to develop a program that will accommodate both the AmeriTAC and EuroTAC groups.

"The meeting also contains sessions which deal with questions that have been asked on the TAC Forum. Such sessions have not been part of the EuroTAC meetings, and I really look forward to joining it," she concludes.

While it's challenging to plan beyond the fall meetings, MTI is expecting to proceed with the regularly scheduled face-to-face TAC Meetings in 2021. The 2021 events and dates currently scheduled are available at www.mti-global.org/events/calendar. MTI will make announcements if there are any changes as we move forward. ▪

REACTIVE AND REFRACTORY METALS BOOK PROJECT NEARING COMPLETION

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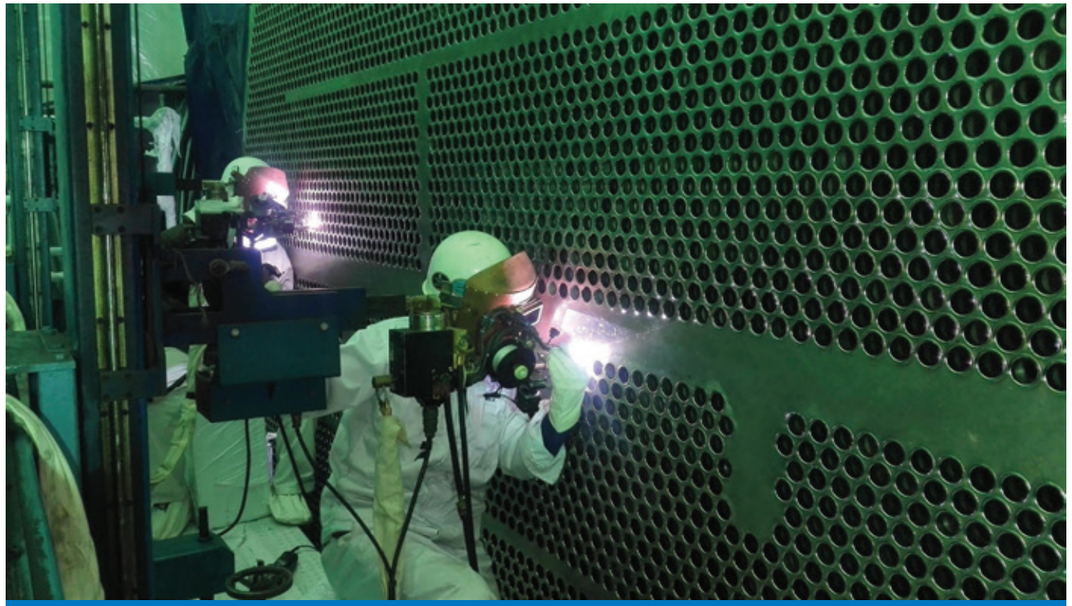

Automatic orbital GTA wire added tube to tubesheet welding of a large surface condenser. Photo courtesy of Albemarle.

The book will be available in both print and digital formats, with the digital format being searchable.

Reactive and Refractory Metals Best Practices is built on the authors' and editors' decades of experience working with these unique materials. "This book represents an unprecedented compilation related to the use of Reactive and Refractory metals in the CPI and should serve as a very powerful tool for the successful use of these exotic and highly valued materials," points out Hardin Wells (Albemarle), Project Co-Champion. "The breadth of knowledge being captured in this book is incredible and is reflective of the lifetime learnings from four senior subject matter experts (authors Jim McMaster, Rick Sutherlin, Kurt Moser, and John Banker), along with the seasoned project team and our special technical editor, David Frey."

The timing for this MTI member resource couldn't be better with so many SMEs retired or on the verge of leaving the workforce (including some of the guidebook's authors). "This book will be a valuable resource to new employees with limited experience but can also serve as a refresher or quick verification tool for seasoned professionals," notes McGowan. She adds that only MTI members will have access to this one-of-a-kind reference, which will be of great interest to the industry at large, but not released to the public until a much later date and at a significantly higher fee.

The project team is eager to see how membership utilizes the book when it is released. Wells has already applied what he has learned during the information-gathering process to help manage his company's reactive and refractory metals-related projects. "The fantastic thing about the book is that MTI member companies will be able to use it in many ways," he explains. "It's not just for training and development of their own subject matter experts and those engaged with reactive and refractory metals, but also for a wide range of end use activities. Activities such as materials selection, equipment specification, design evaluations, vendor selection, raw materials sourcing, fabrication controls, inspection techniques, quality control guidance and much more."

If early returns on investment in the form of supplying safety and other information to members is any indication, Reactive and Refractory Metals Best Practices will be one of MTI's most valuable resources for many years to come. For further information on this project or to join the project team, visit mti-global.org. ▪

Materials Technology Institute
1001 Craig Road, Suite 490
St. Louis, MO 63146
www.mti-global.org

MTI SCHOLARSHIP OPEN FOR APPLICATIONS THIS FALL

The Materials Technology Institute seeks college students who show an interest in pursuing a career related to Materials Engineering in the Process Industries to apply for the prestigious 2021 Bert Krisher Memorial Scholarship. MTI selects two applicants to receive the award, which includes $5,000 each to help cover educational expenses. Students may begin applying September 1, 2020.

Undergraduate students from around the world are eligible to submit their qualifications for the scholarships. Qualified applications include students enrolled in Materials Engineering, Materials Science, Corrosion Engineering, and other relevant programs; relevant coursework (completed or scheduled); academic achievement; personal and professional activities; work experience; and letters of recommendation.

"This scholarship is addressing the primary objective of encouraging qualified engineers to pursue a career in Process Industries-related Materials Engineering," notes Srini Kesavan (FMC), Scholarship Committee Chair. Previous scholarship winners have been from many different schools in the USA and Europe. The majority of them are now employed as full-time materials engineers within the Process Industries."

MTI members will have access to this pool of applicants for consideration as interns/co-ops and possible development as future employees. MTI Scholarships offers the unique opportunity to network and build future working relationships with some of the most notable engineers in the process industries. For students, having the chance to attend an AmeriTAC Meeting is a highly regarded benefit of winning the MTI scholarship for this reason.

Applications, requirements, instructions, selection process details, and more is available at NACE.org. To enter, all required paperwork must be received no later than January 1, 2021. ▪