A Materials Technology Institute Publication

MTI CONNECT

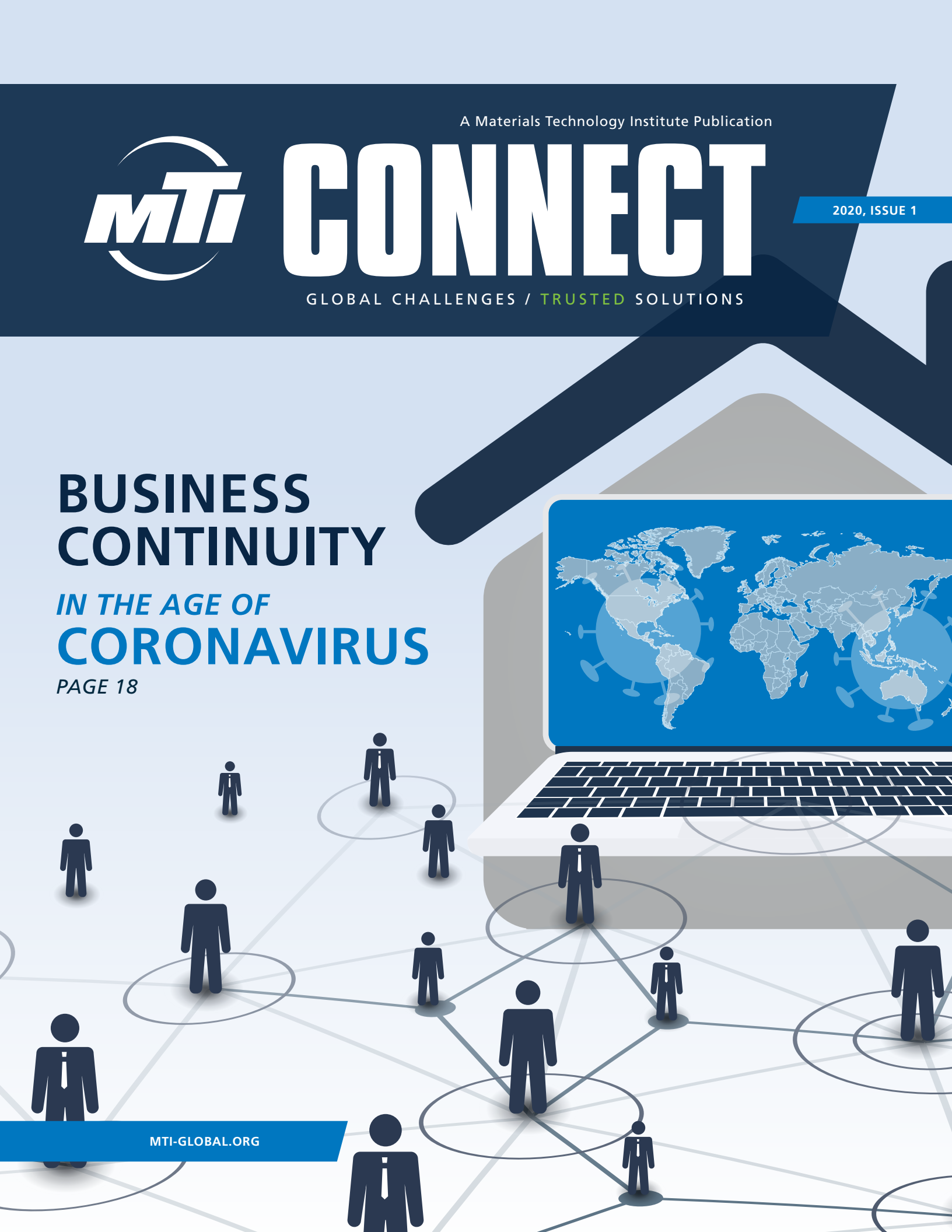
GLOBAL CHALLENGES / TRUSTED SOLUTIONS

2020, ISSUE 1

BUSINESS CONTINUITY

IN THE AGE OF CORONAVIRUS

PAGE 18



CONNECT

Inside This Issue

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.

CONTACT:

Submit all correspondence regarding MTI CONNECT to:
Materials Technology Institute, Inc.
1001 Craig Road, Suite 490
St. Louis, MO 63146
1-314-567-4111 (telephone)
mtiadmin@mti-global.org

MTI CONNECT EDITORIAL BOARD:

SUBSCRIPTIONS:

For a free subscription, write to MTI or contact ***mtiadmin@mti-global.org***

WEBSITE:

http://www.mti-global.org

Please contact us at 1-314-567-4111 or mtiadmin@mti-global.org for more information or to find out how your company can become a member.

CALENDAR OF EVENTS:

AsiaTAC
September 2020
Shanghai, China

Elastomer Training Course
October 26, 2020
Houston, Texas

AmeriTAC 133
October 27-28, 2020
Houston, Texas

EuroTAC
November 17-19, 2020
Ludwigshafen am Rhein
Germany

GLOBAL LEADERSHIP: MTI BOARD OF DIRECTORS 2020

MTI Membership voted to set the number of directors and install the slate of directors and ex officio members for the MTI Board of Directors (BOD) 2020, on October 30, 2019 at the MTI Annual Meeting.

The nominations committee moved that the number of directors be set at 14 plus the four ex officio members (AmeriTAC Chair and Vice Chair, EuroTAC Chair, and AsiaTAC Chair) for a total of 18. The motion carried. The committee then moved to approve the following slate for the 2020 BOD:

- David Barber, Dow (Chair)
- Bill Bieber, Webco Industries
- Eileen Chant, Becht Engineering Co. Inc.
- George Donald, NOVA Chemicals Corporation
- Dale Heffner, Electro Chemical Co.
- Srini Kesavan, FMC Corporation
- Debra McCauley, Chemours (Vice Chair)
- Maria Jose Landeira Oestergaard, Haldor Topsoe
- Charles Young, Tricor Industrial Inc.
- Nina Young, Chevron Phillips Chemical Company

There were no additional nominations to the slate of directors proposed, and the motion to accept the slate was approved.

Finally, the nominations committee made motions to approve each of the TAC Chairs and Vice Chairs. The membership approved Marc Cook (Dow) and Jeremy Nelson (Koch Industries) to serve as the Chair and Vice Chair for AmeriTAC; TP Cheng (ITRI), Alex Chen (Dow) and Masao Nakahara (Asahi Kasei) as the Chair and co-Vice Chairs for AsiaTAC; Anette Hansson (Haldor Topsoe) and Lars Rose (DuPont) as the Chair and Vice Chair for EuroTAC.

Congratulations and thank you to the organization's leaders for their dedication and support. ▪

Members of the Board of Directors (BOD) function as the keepers of MTI's strategic objectives. They provide consistent, valuable input, while maintaining the MTI mission. Left to right: Jeremy Nelson (Koch Industries), George Donald (NOVA Chemicals), TP Cheng (ITRI), Eileen Chant (Becht Engineering Co.), Srini Kesavan (FMC), Debra McCauley (Chemours), David Barber (Dow), Nina Young (Chevron Phillips Chemical Company), Bill Bieber (Webco Industries), Maria Jose Oestergaard (Haldor Topsoe), Dale Heffner (Electro Chemical Co.), Chuck Young (Tricor Industrial), Marc Cook (Dow) Not Present: Anette Hansson (Haldor Topsoe)

FORMER BOARD MEMBER AND AVID MTI FAN ROBERT SINKO NAMED FELLOW

Robert Sinko (Eastman Chemical) is such a big believer in MTI that, not only does he wear his heart on his sleeve, but he displays the organization's logo on his head. From pictures in newsletters and the website to live AmeriTAC Meetings, he can be seen sporting a beige ballcap with the recognizable blue brand just above the bill. One of the Material Technology Institute's most active contributors and faithful supporters, Sinko was named its latest Fellow at AmeriTAC 130 in Baton Rouge on February 19, 2020.

When Eastman colleague and MTI Fellow Gary Whittaker brought him to his first MTI Meeting in June of 1995, Sinko was in awe. "It was in Frankfurt, Kentucky," he remembers. "Man, it was humbling because you had all these guys like Bert Krisher and Joe Demo, and I can see some of the other faces, but I just can't remember the names. You had these titans of the materials world discussing things and good naturedly arguing back and forth. If you go back and look at the forum questions then, because that is what I'm talking about, it was really awesome to see!" He was sold and has been a very active participant in his own right ever since.

Why has he devoted so much time to MTI? "It helps to like it, right?" says Sinko. "I've liked it to the point of loving it almost. Being able to argue with my peers made me a stronger person. When I come back to Eastman to work on things, I don't have to be intimidated by Chemical or Mechanical Engineers. I can hold my own, and I know when to keep my mouth shut when it's not my materials issues. I know when to turn it over, but on the other hand, I'm not going to get steam-rolled."

Robert Sinko (Eastman Chemical) accepts the MTI Fellow Award plaque from David Barber (Dow), MTI BOD Chair, during an MTI reception to bestow Sinko with the highest of MTI honors.

He knows that he can turn to the MTI online forum network when he needs answers.

One of Sinko's most memorable experiences at MTI was the June 2012 AmeriTAC Meeting in Seattle. "I was the TAC Chair," he recalls. "It was really great because my two younger compatriots came as well, Curtis Huddle and Cameron Curtis, and they brought their significant others, and I brought my wife Linda." There was also an unexpected twist at the meeting that added another label to one of MTI's most colorful characters. "That was the meeting where we had the melted ice cream and that has stuck with me forever," laughs Sinko. "There was a really good discussion about a project Bob Hurst was fronting for, and it was to do with the Titanium Hydrides and testing. Normally, when they bring the ice cream in, it's in individual serving components – bars, cones, and all that. They usually bring it in in a refrigerated box and plug it in. But this time, the hotel put big mounds of ice cream in big bowls. It was sitting there and waiting for us to get out and get it, and it literally had a meltdown. I'm still reminded of that. People were upset (mostly Robert), but overall, it was still a great event!" chuckles the good-humored Fellow.

Ice cream incidents and puns aside, Sinko has seen great success through participation in the bread and butter of MTI value: its projects. He says one of his favorites was creating an Elastomers Training program in the 1997-98 timeframe. "It helped so many people in so many different ways," he points out. "It brought us all up to a standard level. It gave the Dow/DuPont Elastomers business a way to change

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GLOBAL TAC UPDATE

PLANS FOR ASIATAC, EUROTAC AND AMERITAC AMID COVID-19 PANDEMIC

MTI's worldwide Technical Advisory Council Meetings are typically held seven times per year – three in North America, two in Europe and two in Asia. This year, MTI has canceled three meetings due to the current health crisis around the world. Leadership for the three TACs hopes to continue planning in order to hold the remaining meetings in the second half of 2020, as well as virtual options to help keep members connected to MTI projects, information and resources.

In the face of the global COVID-19 pandemic, the regional TAC leadership teams made the difficult decision in early March to cancel both the AsiaTAC and EuroTAC Spring 2020 meetings. The AsiaTAC leadership team decided to cancel the Spring Conference originally scheduled in Da Nang, Vietnam from March 8-9, 2020. The team hoped it could postpone the event to May, but the decision to cancel was necessary due to the explosive spread of COVID-19 and the Vietnam government ban on meetings. EuroTAC leadership was faced with the same decision. The Spring EuroTAC Meeting, scheduled May 25-27, 2020, at the Institute de Soudure, was to include a Ceramics 201 Training session, but both have been canceled due to the impact of COVID-19.

The widespread growth of COVID-19 in the United States caused concerns that the virus could also impact the AmeriTAC 132 meeting, scheduled June 22-24, 2020, in Kansas City, MO. The Board of Directors met on March 27, 2020 and made the decision to cancel AmeriTAC 132 face to face. However, the AmeriTAC leadership team is working on an alternate plan to continue providing technical content and still hold MTI project team meetings.

The team proposed an idea to hold a virtual TAC 132 and project meetings. This method of connecting will allow members to continue learning and participating within MTI, as well as engage additional participants beyond the usual AmeriTAC attendance, including members from AsiaTAC and EuroTAC. More information about the virtual meetings will be released when plans are confirmed. ▪

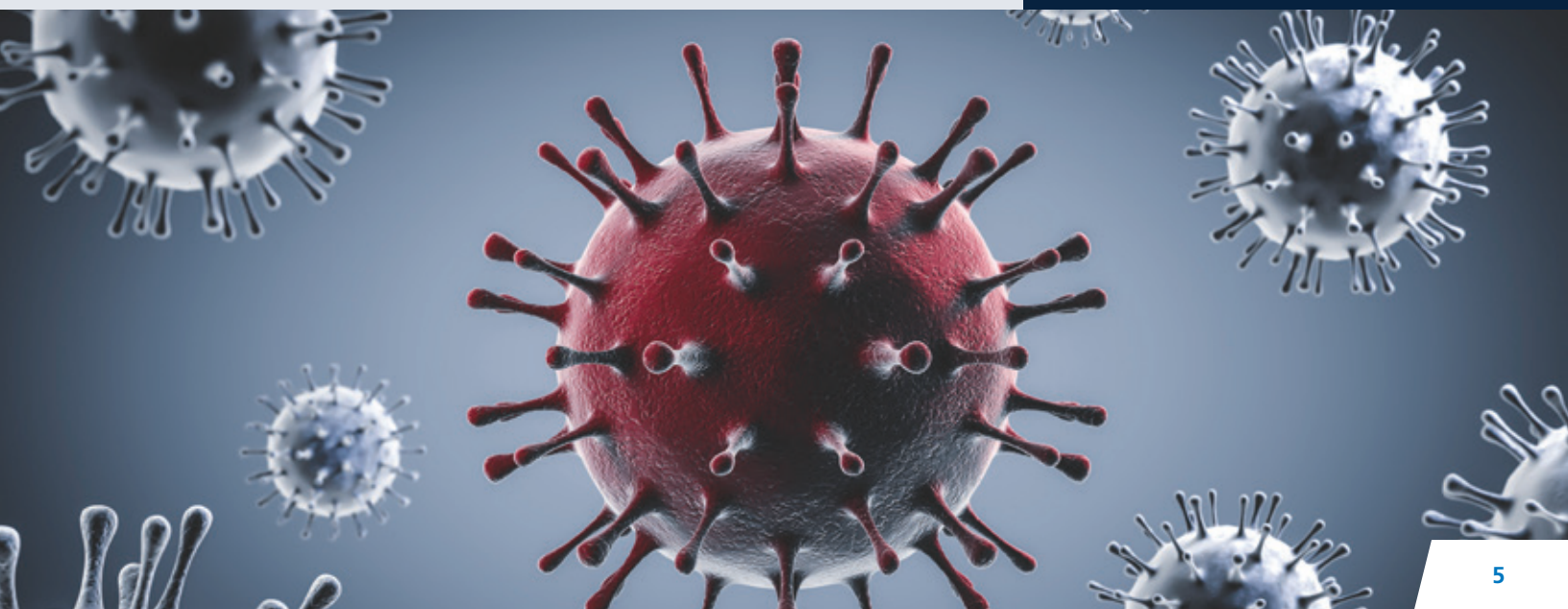
FUTURE MEETINGS

AsiaTAC
The 2020 Fall Conference is tentatively scheduled in mid-September to be held in Shanghai, China and details will be worked out in the near future. Leadership has also decided to host the Spring conference in Da Nang, Vietnam during mid-March 2021.

AmeriTAC
The AmeriTAC 133 Meeting is currently scheduled October 26-28, 2020, in Houston, TX. It will feature an Elastomer Training Course, as well as the Annual Member Meeting.

EuroTAC
The Fall EuroTAC Meeting is scheduled November 17-19, 2020 at the BASF facility, Ludwigshafen am Rhein.

More information and details for future TAC meetings will be provided as they become available. Thank you to all MTI members for your continued patience and support as we navigate this unprecedented situation affecting the world.



NEW SUPPLIER MEMBER'S PARTICIPATION BRINGS VALUE TO MTI

MTI gained Enerfab as a member in 2019. Since joining, Enerfab has been participating and attending meetings. In this issue, they share their company capabilities and involvement in MTI.

Enerfab's history spans more than a century. Founded in 1901, the company began making sealants and lacquers for tanks and vessels. Since then, it has continually grown and is now an industry leader in fabrication, maintenance and construction services.

Their ASME Sec. VIII, Div. 1 & 2 fabrication facilities, including a 250,000 square foot shop in Cincinnati, and expertise with jacketed reactor vessels, heat exchangers, Heavy Wall Reactors, refinery towers, piping, turnkey modules and much more in stainless steel, duplex, nickel alloys and clad construction (explosion bonded, roll bonded and weld overlay), allows the business to handle some of the most complex challenges in the chemical, refining and other industries. In addition, Enerfab offers single-source solutions for field erection of fabricated equipment, capital construction projects, and on-site maintenance, as well as capabilities across all major crafts and specialty services such as protective coatings and linings, refractory, and instrumentation and controls.

"We work with customers to find solutions to issues with their critical process equipment to extend life expectancy and increase productivity," explains Kelly Wyrough, Designated Representative. "Recently we worked with a customer to see how much cold and hot forming changed the metallurgy of Duplex heads and whether they should be solution annealed or not after forming. Putting monies into research and development at Enerfab has made us partner with our customers as a solutions provider."

Enerfab decided to become an MTI member last year because they work every day to solve critical issues and MTI provides leadership and resources to develop solutions for the process industries.

"MTI gives us the arena for our team to learn next to the best in the industry as well as contribute to projects with our knowledge and expertise in the area of pressure

vessel fabrication, welding and maintenance," she states.

With Enerfab's vast experiences in many processing industries, their team can contribute to the different areas of MTI, including materials engineering, fabrication techniques and research and development.

"We believe MTI is most beneficial to our team by getting involved in projects, and we've been doing so for the past year," Wyrough describes. "One project stands out as we got involved day one of our membership and that is the MTI R-14 Guidelines for Selection and Use of Flux Cored and Gas Metal Arc Welding Processes in the Chemical Process Industry project. The industry has a stigma on utilizing fluxcore; however, that dates way back and many things have changed since the 1970s and 80s and for the better. We are excited to participate and contribute to the projects and research."

MTI is happy to see Enerfab dive into the projects and meetings and take advantage of the resources the organization offers, but this doesn't come as a surprise since Wyrough is a veteran MTI participant.

"We are, of course, pleased to have Kelly Wyrough back with MTI. Kelly has been sharing her expertise with MTI since 1997 and previously served as a Board Director," remarks Paul Whitcraft, MTI Executive Director. "What's more, her engagement with Enerfab brings additional expertise from one of the industry's largest fabricators. Enerfab has been using the latest technology to construct tanks, vessels and piping systems since 1901. They are an excellent addition to the MTI organization, and we look forward to their continued participation."

Enerfab offers a multitude of services and solutions for fabrication, maintenance and construction in chemical, refining and other industries.

Continuing the company's involvement is exactly what Wyrough plans to do. In addition to participating in projects, she says the TAC Forum and e-Library have already been a tremendous assistance and the company hopes to continue taking full advantage of what MTI has to offer.

"The networking benefits have already proved invaluable to our team, and we're looking forward to how we can collaborate with technical experts and influence the industry with our expert knowledge in fabrication, continuous improvements, and technical quality," Wyrough concludes.

Please help MTI welcome Enerfab! For more information about the company, please visit https://enerfab.com/. ▪

A MAJOR PLANT UPGRADE PROJECT FOR

REDUCTION OF EMI

GUY COOPER, BRIAN FERRIS, HONGTAO LU, BRAD MORRISON, DAVID CLIFT, MOHAMMAD MOHSIN, BRIAN GILLILAND, KAM SIRIKAN, ANDRÉS MAHECHA-BOTERO

NORAM ENGINEERING AND CONSTRUCTORS LTD., VANCOUVER, BC, CANADA

A phosphate fertilizer complex in Western United States operates two sulfuric acid plants. The first of these two sulfuric acid plants started up in 1984, and the plant has done an excellent job in maintaining and operating the sulfuric acid plant. NORAM has worked with the plant in several projects for sulfuric acid plant improvements. However, after more than 30 years of operation, the aging catalytic converter (a major part of the plant) needed to be replaced for reliability reasons, and in 2014, when the plant personnel determined that the converter needed to be replaced, this major upgrade project started. This article highlights the successful completion of a major upgrade of sulfuric acid plant at the phosphate fertilizer complex in 2019, which included a converter, a gas-to-gas heat exchanger, an economizer, and process gas ducting (Figure 1).

Design Challenges

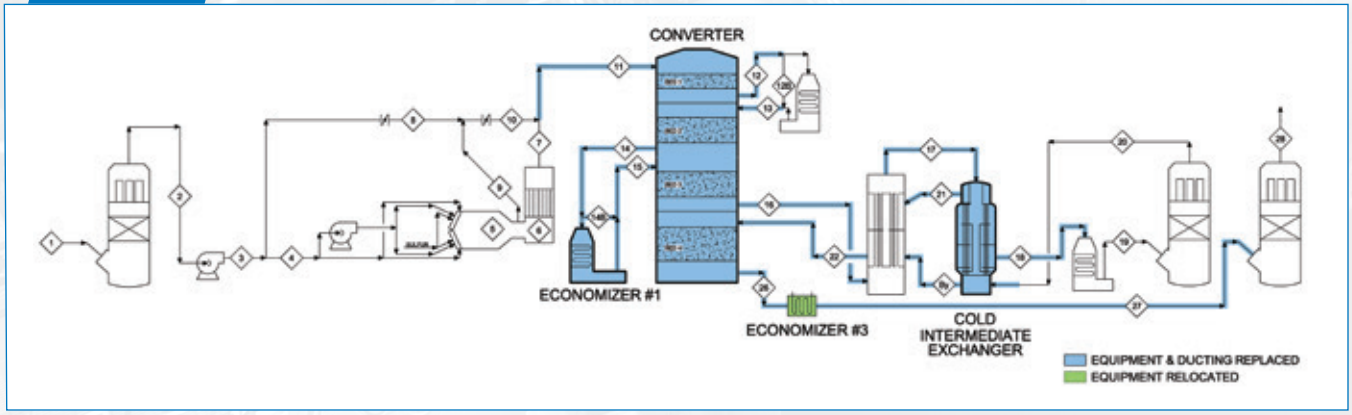
The project started in 2014 with a NORAM pre-feasibility study that simulated the entire sulfuric acid plant and identified the process requirements for the project. NORAM spent significant time identifying the optimum design configuration and worked on minimizing emissions with the new system. The project execution was challenging, and with the limited space adjacent to the converter, it seemed impossible to remove the old one and install a new one. In addition, the high pipe racks and ducting surround the converter made crane access from outside the converter area extremely difficult.

Pre-Feasibility Study

NORAM developed a converter design and evaluated project execution options. NORAM recommended replacing the existing five-bed catalytic converter by a four-bed converter, which is a typical 3:1 double contact double absorption converter arrangement (three catalyst beds before the interpass tower and one catalyst bed after). The new catalyst configuration considered for the new converter and catalyst configuration would reduce the emissions significantly.

However, as a result, the heat generated from the conversion would increase and the heat removal steam equipment (i.e. economizer #1) cooling the gas between the second and third converter passes would be undersized and would need to be replaced in conjunction with the converter. Three main options (Table 1) for installation of the converter were considered: (1) New Location; (2) Lift-in; and (3) Roll-in. In conclusion, the plant personnel selected the "Roll In" strategy in which economizer #3

FIGURE 1 Equipment replaced and relocated by NORAM.



SSIONS

would be moved over several feet creating space for a new larger converter erection during the May 2017 shutdown, two years prior to the converter installation shutdown. NORAM referred to this economizer movement as "The Morrison Shift" (Figure 2).

Shutdown Preparation Work

During the May 2017 shutdown, the usual turnaround routine was performed, including catalyst screening and semi-annual maintenance checks. A couple tasks were also done in preparation for the 2019 converter installation. The economizer #3 was relocated to an adjacent area by shifting it about 15 feet to the north. The new stainless-steel ducting segment connecting economizer #3 to the converter and the final absorption tower were designed and supplied by NORAM. The ducting was fabricated at NORAM's fabrication shop, Axton, located near Vancouver (Figure 3). The sacrificial portion of the existing cold gas exchanger (an older design prone to gas leaks) was removed and the new ducting connecting this exchanger with the interpass tower exit SO2 gas was also designed and supplied by NORAM. At this time, this cold exchanger was earmarked for replacement in 2019 along with the converter.

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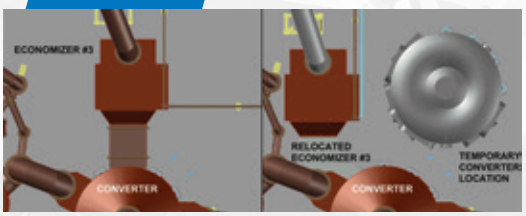
FIGURE 2



Economizer #3 Before and After Shift.

FIGURE 3

Large Ducts at Axton for May 2017 Install.

TABLE 1 *Three Main Options For Project Execution During Pre-Feasibility Study*

New Location

- Erecting the new converter on a permanent location about 250 feet west of the present converter.
- Minimizing the shutdown duration but would be expensive and difficult to run eight ducts to and from the new location.
- The footprint of the sulfuric acid plant would need to be extended significantly.

Lift-in

- Erecting the new converter on a temporary foundation outside of the converter area.
- Demolishing in place and removing the existing converter during the shutdown. Then, lifting in the new converter over the pipe racks and ducting on to the existing foundation.
- Allowing easy erection of the converter modules prior to shut down in a spacious area. It would require a large crane with a long reach. It may have required the insulated converter to be lifted-in as two pieces due to crane loading limitations. With the legendary local winter weather, this could cause schedule delays during a critical lift.

Roll-in

- Erecting the new converter modules on a temporary foundation inside the converter area.
- Demolishing in place and removing the existing converter during the shutdown. Then, roll in the new converter during the shutdown.
- Sounds easy but the crowded space for converter module erection might be troublesome. However, NORAM's lead designer, Brad Morrison, had a "eureka moment" for creating a larger space to erect a new larger converter by moving economizer #3.

Basic Engineering

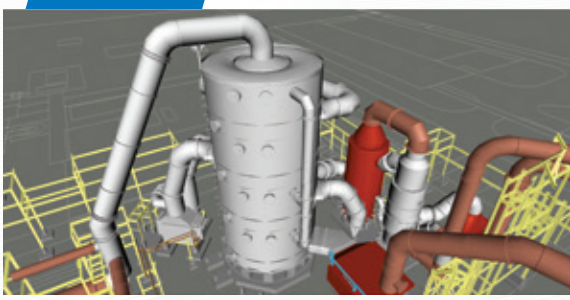
After the shutdown, NORAM started a Front End Loading Study (FEL 3), also known as Basic Engineering for the upgrade project in where the design of the new converter was finalized, and the cold gas exchanger and the economizer #1 were designed (Figures 4 and 5). The existing converter, at 31.5 feet diameter, had been designed for the lower plant capacity. Gas velocities increased to unacceptable levels as the plant capacity increased over time. NORAM's simulations concluded that the new converter diameter should increase by 4.5 feet to 36 feet diameter, which was equivalent to a 31% increase in cross sectional area. Also, after a close review of the converter location, it was found there was sufficient radial clearance to allow a 36-foot diameter converter. The new converter would have four catalyst beds and would have NORAM's proprietary welded stainless-steel post and catenary plate design, which maximize the cross-sectional area as it does not have a center support core.

The new converter would also be designed to keep nozzle elevation and locations close to the existing converter nozzles. Even though there was significant new ducting replacement to be included as part of the upgrade, the existing connecting equipment would be in the same location and so the new ducting runs had to be similar to the existing runs. By changing from the existing 5-Bed to a new 4-Bed design, the converter could accommodate increased catalyst depths and allowed the converter design to match nozzle elevations. Catalyst manufacturers were invited to prepare catalyst designs to achieve the required low SO2 emissions for this converter. The cold gas exchanger with the old design of a sacrificial shell and tube section required frequent replacement due to acid condensation and corrosion. The new cold exchanger design would be a NORAM exchanger with a hot-sweep feature to reduce condensation. This feature eliminated the need for a sacrificial section and replicated the NORAM design that had been successfully operating for 15 years in another plant. The new 304 stainless steel cold gas exchanger was designed for low pressure drop operation and met all heat transfer requirements. Due to the higher heat loading of the new catalyst designs, the existing economizer was undersized, and a replacement with increased capacity was required.

The converter dimensions of 75 feet tall by 36 feet diameter, negated shipping in one piece. NORAM and fabricators evaluated shipping the converter in seven rings with each ring split into 90° sections for a total of 28 modules. NORAM's proprietary all-welded stainless post and catenary plate design allowed for significant degree of shop fabrication reducing field assembly.

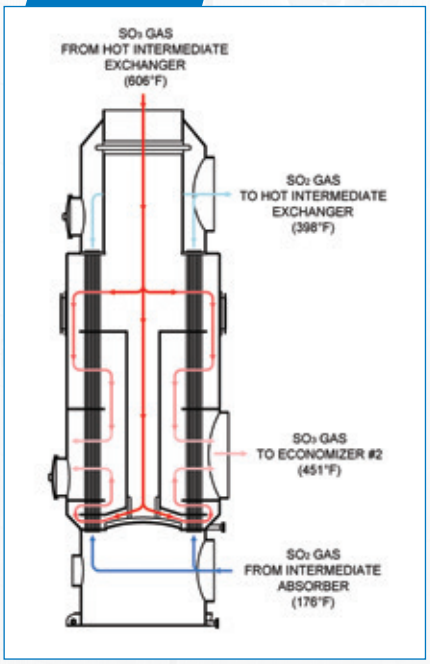
The strategy for removal of the existing converter and installation of the new converter was reevaluated by NORAM, the plant personnel and prospective construction contractors and was narrowed down to two methods (Table 2): (1) Demo and wheel-in, and (2) Demo and

FIGURE 4



A 3D Model with New Equipment in Light Grey. Converter: 75 feet tall by 36 feet diameter.

FIGURE 5



NORAM's Cold Exchanger with Hot Sweep.

TABLE 2 *Two Main Options for Project Execution During Basic Engineering*

Demo and wheel-in	Demo and lift-in
• The converter modules would be erected adjacent to the converter while the plant is operating.	• The converter modules would be erected adjacent to the converter while the plant operated.
• This was the original strategy from Pre-Feasibility Study, in which, in the May 2017, the economizer relocation gave elbow room for erection.	• The converter modules would be assembled in area outside of the pipe racks and ducting of the main gas components.
• During the shutdown, the existing converter would be demolished in place and the new converter rolled in.	• During the shutdown, the existing converter would be demolished and the new converter, in one or two pieces, lifted over the ducting and pipe racks lowered on the existing converter foundation.

lift-in. After review of the bids and discussion with contractors, the Demo and wheel-in option was the preferred strategy.

Detailed Engineering and Equipment Supply

Several months later, in December 2017, NORAM was awarded detailed engineering for the final stage of the project. This work included a comprehensive set of drawings and designs for the project, including ducting, expansions joints, updated simulations, Process Flow Diagrams, P&ID's, equipment specifications, stress analysis, and so forth.

In April 2018, after the detailed engineering stage, NORAM was awarded the supply of a NORAM Cold Exchanger with Hot Sweep, a NORAM stainless converter, and 16 replacement ducting segments. The new 36-foot diameter four bed converter was designed with stainless steel 304H for above 800°F temperature service. It was designed to hold large volumes of catalyst to ensure high conversion over a wide range of operating and catalyst conditions. NORAM designed and supplied a replacement cold exchanger in 304 stainless steel with a hot sweep, which was fabricated by NORAM's fabrication shop, Axton (Figure 6). The design was a modern radial flow with a high heat transfer as compared to the old single-segmental design. A schematic showing the flow paths of the converter is given in Figure 5.

The new ducts were fabricated from 304H stainless steel for the hot non-condensing service, whereas for the potentially condensing service, they were specified as 316L and 316H for cold service and hot service, respectively. The ducting diameters were up to 84" and the design pressure was 10.5 PSIG. There were eight new dampers supplied as part of the replacement ducting, varying in size from 30" to 78" diameter. A total of 29 expansion joints were used to handle the differential expansion for the 16 ducts, and the materials of construction for the expansion joints were a combination of 316L, 316H, 304H, and A-240 253MA. New economizer #1 process specifications for a replacement were prepared by NORAM, and the client awarded design and fabrication of the economizer to Optimus of Tulsa, OK. Figure 7 shows the equipment after shop fabrication.

FIGURE 6

Shop Fabrication of NORAM gas-to-gas Hot Sweep heat exchanger. *Left:* Tube installation. *Right:* Tube-to-tubesheet welding.

FIGURE 7

Transport of NORAM ducting, expansion joints, converter modules and gas exchanger.

Final Installation

NORAM awarded the converter fabrication to Central Maintenance and Welding (CMW) out of central Florida who delivered the 28 converter modules to the site from September through December 2018. The client also retained CMW as their construction contractor to install the equipment. From September 2018 through January 2019, CMW erected the converter modules. Despite the best planning intentions, CMW did experience

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FIGURE 8

Converter assembly. *Left:* Crane loading. *Center:* Welding of catalyst support. *Right:* Bed assembly.

some of the finest (harshest) local winter weather at the end of the completion. Figure 8 shows the assembly of the converter modules, while Figure 9 shows the installation of the converter internals.

In May 2019, the new converter, cold exchanger, economizer, and 16 duct segments were installed. NORAM provided advisory construction services. The shutdown work went well, and the plant was ready to start-up on schedule at the beginning of June. Figures 10 and 11 present the installation of ducting and the final stages of the converter erection.

Startup and Performance Evaluation

Figure 12 shows the final site installation work, while Figure 13 presents the converter prior to start-up. The start-up went smoothly, and the plant reported process performance that met or exceeded specifications. The plant was designed for 2100 STPD. The NORAM design achieved emissions that were only a fraction of those prior to the upgrade project. ▪

FIGURE 9

Installation of converter internals.
Top Left: Brick lined first pass. Top Right: Installation of NORAM HP packing.
Bottom Left: Installation of quartz rock. Bottom Right: Catalyst installation.

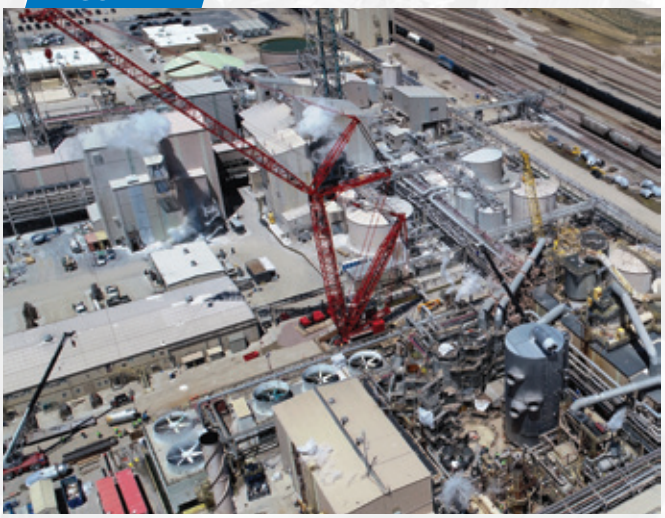
FIGURE 10

Ducting installation.

FIGURE 11

Converter assembly.

FIGURE 12



Site construction work.

FIGURE 13

Final installation.

LEADING ASIATAC

CHAIR TP CHENG DISCUSSES STRATEGY

Tzu-Ping (TP) Cheng, ITRI, began participating in MTI in 2012-2013 when he and a colleague were invited to attend both the AmeriTAC and AsiaTAC meetings as guests. After learning about MTI and its benefits, it became his personal mission for ITRI to become a member, and he succeeded in 2014. He serves as the company's Designated and TAC Representatives and has been an active participant since joining MTI. He was elected as AsiaTAC Vice Chair in 2015 and has been the AsiaTAC Chair since 2018.

Cheng, as Chair, is tasked with developing strategy and working to increase awareness about MTI. Asia is the largest continent but has the fewest MTI member companies. AsiaTAC's strategy is focused on two points: (1) improving services to member company employees in the Asia Region, and (2) promoting the MTI brand in the region and actively recruiting new members. This is typically done by holding AsiaTAC meetings in locations that could potentially attract new members, as well as locations that will serve the regularly participating members.

Tzu-Ping (TP) Cheng, ITRI

"Since 2013, AsiaTAC has hosted two TAC meetings annually," Cheng explains. "The spring meeting takes place outside of China with one major intention – to approach and to serve production sites in eastern and southeastern Asia regions. And the fall meeting is always held in China, mainly near Shanghai, because most members have producing sites and offices in this area."

As a leader, Cheng must understand and learn what problems different countries or regions in Asia face in order to help AsiaTAC carry out its strategy.

"The operating history of the Chemical Processing Industry (CPI) in Asia is shorter than those in Europe and in America," he reports. "Relatively newer plants and less experienced engineers request lots of training classes, which cover literally all aspects of material engineering. Unlike their mother companies, most members operate production sites in Asia which are not equipped with a team of experienced corrosion and inspection experts. Hence the major efforts of AsiaTAC meetings focus not only on technical presentation and discussion, but also on case studies and trainings, which are one of the prime attractions for local engineers."

According to Cheng, members crave training at AsiaTAC, so many of the MTI projects are mostly training ideas that can be developed and offered as half, one or two-day training sessions at future meetings.

"Much less time is used to develop long term research projects as other TACs accomplish," he notes. "Nevertheless, a research-oriented project has been completed on building up a corrosion rate database for the most commonly used nickel alloys, and the next phase of such a project is now developing."

The leadership team is also faced with the challenges of recruiting

Photo: Kuala Lumpur, Malaysia

new members. Most of the refineries and petrochemical plants in Asia are subsidiaries of the state-owned giant companies. To recruit a public company is not an easy task because, while the merits of joining MTI are obvious to plant engineers, they are not recognized by top managers.

"The solution is to invite the potential member companies to attend the AsiaTAC meeting and to create a positive and professional image," Cheng says. "Fortunately, the spring meetings have been successfully hosted and assisted by local partners, such as National Metal and Materials Technology Center (Thailand), Nanyang Technological University (Singapore), and Indian Institute of Technology Bombay (India). AsiaTAC believes hosting the meetings both in China and outside of China is a good strategy to attract and to grow attendance and will stick to the plan. So far, there is some territory, such as Malaysia and Indonesia, that MTI has never explored. Once a trusted and enthusiastic partner is found, a spring meeting in that country will be organized."

Although they are making great strides, Cheng says he didn't do this on his own.

"The achievements of TAC meetings and leading of AsiaTAC would not be feasible without the continued support from MTI Associate Directors, former AsiaTAC Chair, present vice chairs, and a multitude of zealous members," he concludes. "Whenever and wherever AsiaTAC needs the planned work done in time, great help is always available or on the way to push the schedule one step forward to finish as planned." ▪

FORMER BOARD MEMBER AND AVID MTI FAN ROBERT SINKO NAMED FELLOW

> CONTINUED FROM PAGE 4

their marketing technique, so it wasn't so much overselling. Now that they knew what engineers really wanted, and they could modify their sales pitch to a more technical approach. We also received a big concentration of information in a binder, which really helped my career here at Eastman, dealing with seals and gaskets."

As a mentor, Robert has paid it forward, sharing the lessons he has learned with subsequent generations of Eastman engineers. "What I have done is encourage my young'uns to go ahead and become Project Champions and to be part of projects," he notes. "It helps to build the leadership skills, it helps to learn to negotiate between people and to understand what's right and what's wrong. I would encourage everybody to be a participant because if you just come to sit, and you don't participate, pretty soon you'll just think, 'What a bunch of old farts just blowing smoke.' But if you participate, you start getting skin in the game, and it starts to mean something. That's important!" So is recognizing one of MTI's most valuable players.

At the brief AmeriTAC Ceremony where Sinko was honored, the normally talkative TAC regular was humble and kept his acceptance speech short and appreciative. Afterward he shared, "I'm very happy that it happened and relieved as well. I've been a big supporter of MTI, and I want it to succeed. I wasn't ready to pull the plug and go away. I really do look at the people there like family. We're a really strong team. This allows me a path to continue to participate and to be with family and friends, and that is what I was looking for.

"I'm just very thankful that I have it, and I am hoping to use it to MTI's good!" he continues. "I do look at the Fellow thing as a tool, and I don't really have any instructions on how to use it. I'd like to set up a more active role for that. Just from my observation, Emory Ford is my good role model. I'm going to try to follow after him and keep active even when I retire."

That hasn't happened yet, and he doesn't provide a clue as to when he will make the transition to full-time Fellow. In the meantime, he has timely words of advice for MTI members and staff. "Just be nice to each other so MTI can keep on living and doesn't catch a virus that tears it apart," suggests Sinko. "There will always be challenging days. That was one of the things that I saw on my days on the Board. There's always a challenge, but that's what makes you strong. That's what makes you change. What you have to do is - be nice to each other when that happens." Our hats off to you Robert. Congratulations, and thank you for your commitment to MTI! ▪

MTI DELIVERS SUCCESSFUL 2020 SYMPOSIUM

The Materials Technology Institute (MTI) held its first Global Solutions Symposium February 19-20, 2020 at the Hilton Capitol Center in Baton Rouge, LA. The Symposium exceeded expectations with a record MTI meeting registration of 201 members and non-members. And for the first time, MTI opened a Global Solutions Marketplace of 30 industry partners to offer attendees a chance to meet and network with potential vendors to help meet their company's needs. The event gave attendees the opportunity to engage in various ways from attending keynotes, participating in learning sessions, visiting the Global Marketplace to get "Symposium Passport Stamps", and networking at the receptions.

On Wednesday, February 19, the Symposium opened with a welcome and keynote from Shannon Craig, BASF Vice President, Technical Expertise and Discipline Engineering, about Impacting the World and how BASF and MTI have been working together for 40 years to make a difference. MTI honored BASF with its 40-year anniversary award following the presentation. The rest of the afternoon offered attendees the chance to choose from two technical learning tracks with a total of 11 presentations in Emerging Technology and Turnarounds.

The meeting continued Thursday with a morning keynote on Knowledge Management by Peggy Salvatore, Author and SME, where she provided thoughts and concepts to carry into the Knowledge Management track and workshop throughout the rest of the day. Alongside the KM track, MTI continued offering technical learning sessions (eight presentations) focused on High Temperature Corrosion and Corrosion Under Insulation.

Thank you to the Symposium chairs, session chairs, speakers, exhibitors and attendees for your participation! ▪

Shannon Craig, BASF Vice President of Technical Expertise and Discipline Engineering, holds a Q&A for a captivated audience following his informative opening keynote on February 19, 2020.

Peggy Salvatore delivers the morning keynote, "Managing Knowledge: It's not just Training Anymore," on Thursday, February 20, 2020 at the MTI Global Solutions Symposium.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BUSINESS CONTINU

IN THE AGE OF

ITY

CORONAVIRUS

SEIZE THIS OPPORTUNITY TO ENACT YOUR KNOWLEDGE MANAGEMENT PLAN

BY PEGGY SALVATORE

Many businesses are using this time to do online training for their employees. That's a good idea.

Let me propose a more radical idea – that businesses use this time to create knowledge bases and training materials while your experts may be idled for a time. For all your experts who are usually too busy with the day-to-day work in front of them to capture their knowledge for the next generation of employees, some may be in a slowdown and can be a valuable resource right now.

Remember Y2K?

For those who were in the working world 20 years ago, you probably remember Y2K – that was shorthand for "Year 2000" – when the world's computers were programmed only up to the year 1999. Sometime in 1998 or 1999, emergency plans were put in place by industries just in case computers stopped working at midnight on December 31, 1999. Most businesses worked nonstop for a year or more in the runup to that midnight hour to reprogram computers and game-plan contingencies for computer failures. Businesses ran in crisis mode.

I was working as a consultant in the pharmaceutical industry as part of the White House Task Force on Y2K with a consortium of pharmaceutical manufacturers from the branded and generic industries, the community pharmacies, chain pharmacies and the pharmacists' professional association to plan for the what-ifs. We worked for 9 months to strategize contingencies and advised the presidential transition team from the Clinton to Bush 43 administrations on our work. We discussed:

- Hoarding – what if people panic-buy? They could set a series of drug shortages in motion that could be averted if we keep our rhetoric down.
- What if computers DO shut down, the lights go out, ATMs and gas pumps don't work, pharmacies can't access prescription or payment data? What role will our emergency service workers play in getting critical drugs to patients?
- What if orders can't be sent in? Prescriptions can't be filled?
- How will we get essential medicines to people who are the most vulnerable? Nursing homes? Insulin-dependent?

And on and on…

Our best intelligence told us that nothing was likely to happen, and we should tell people not to panic and not to hoard. If… and only if… the world came to a halt would we defer to Plan B – emergency communications, finding and serving the vulnerable and critical, etc.

Well, fortunately, as you know, nothing happened. All that planning and work culminated in a big goose egg. And we were all delighted. But that didn't happen by accident. It happened because of all the round-the-clock work by computer experts and the support they received from their companies and industries to avert a disaster for a year or more before midnight December 31, 1999.

Which brings us to today. Exactly today, in fact. March 16, 2020.

Today, in suburban Philadelphia, officials are ordering the closure of all restaurants, bars, casinos and forbidding any gatherings of 50 or more people. Weddings are affected. Networking events and professional gatherings are going online or being postponed. But most importantly for our discussions here, many businesses have sent people home to work – if that's possible – or just told them to stay home.

> *CONTINUED ON PAGE 20*

MTI is a Knowledge Management Repository

During times of uncertainty, you can rely on MTI's 24/7 member access to a vast knowledge base of technical information, discussions, networking and projects, all powered through www.mti-global.org. Here are several ways to connect, tap experts and access MTI's growing archive of critical information:

TAC Forum

- Searchable archived topics/replies
- Real-time collaboration between industry experts
- 1-hour average response time

e-Library

- Comprehensive search functions
- Technical reports, presentations, publications and more

Education

- Register for upcoming webinars
- Access archived webinars on-demand

Networking & Communities

- Global member directory
- Active project team discussions and documentation

My hope, harkening back to my Y2K experience, is that this is a big goose egg. Yes, we already have some coronavirus cases and some deaths, but they are in the triple digits right now. If we avoid overwhelming waves of the ill flooding the hospitals, we can all say that the measures we took did their job.

But what is the fallout from an event like this? What does it mean for companies that are working with skeleton crews or shutting down for a while? What do ongoing essential services look like? Who provides these services? How will business resume? What happens if this virus does, indeed, become the #boomerremover?

This is where a strong knowledge management plan is the bedrock of business continuity planning. With well-documented procedures, businesses can keep operating according to SOP during and after unanticipated events.

Like every crisis, this event also holds opportunities for businesses and industries.

Knowledge Management and Business Continuity

The assumption in capturing and preserving critical knowledge in your organization is that:

- you know where it is
- who knows it, and
- you have access to those people when you need them.

The premise of a strong knowledge management plan is that you may not always know who those people are, where they are or have access to them when you need what they know to keep your business running, so you should find them, talk to them and plan ahead.

Up until the coronavirus crisis, my supposition has been that the biggest threat – and it is a very big one – to business continuity is the loss of knowledge of your retiring employees. But today, it is clear that the loss of knowledge can occur from a random, "black swan" event such as the one we are experiencing right now. The coronavirus pandemic threat just underlines the importance of retaining expert knowledge in an era of uncertainty.

And this is doubly true for the MTI audience, many of whom are in the petroleum refining industry, who are also being hit by the oil price drop that will certainly affect planning and operations until the financial markets settle down.

Like every crisis, this event also holds opportunities for businesses and industries.

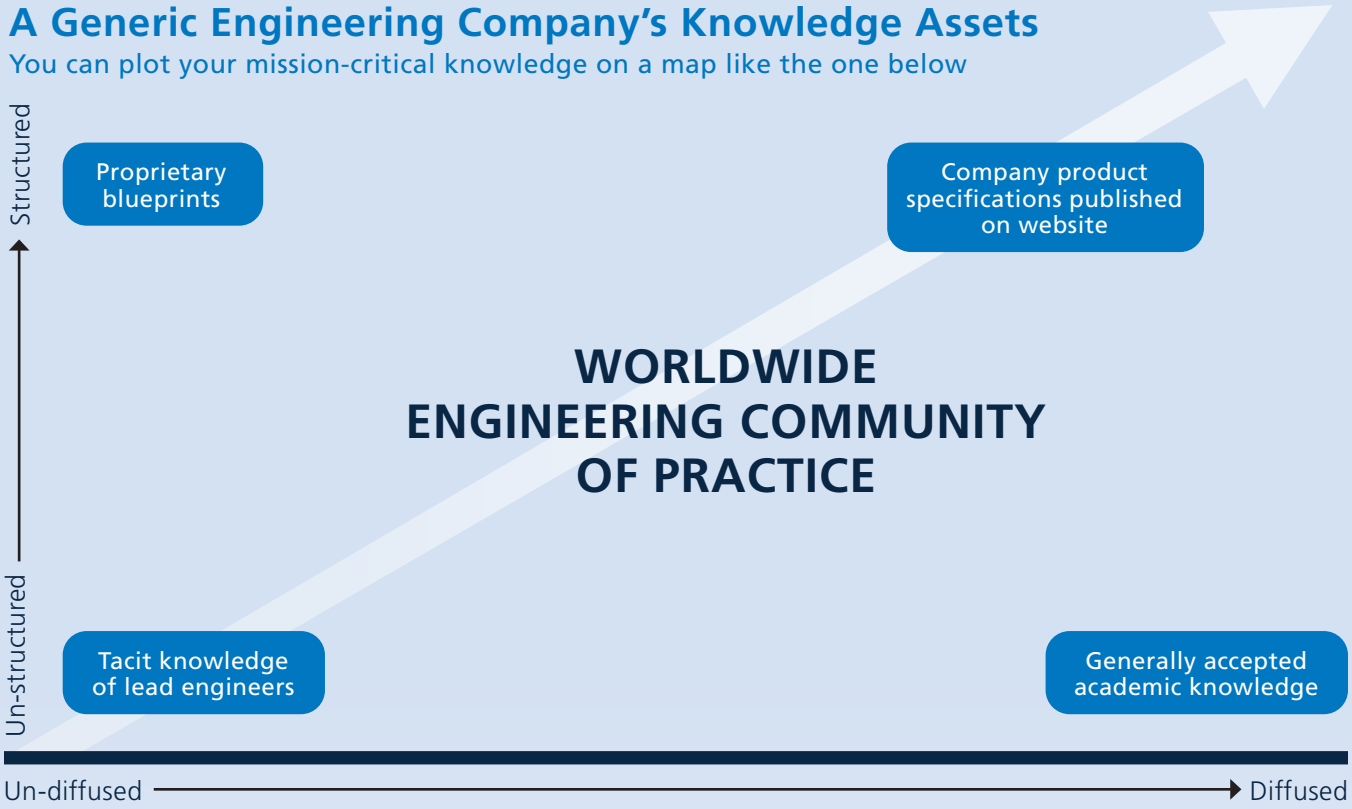
"We're too busy doing the work to document it!"

One of the main complaints I hear from people who are trying to get some time with their subject matter experts to work on knowledge gathering and training is that the experts are so busy doing the work at hand every day, they don't have time for tasks like working with the training department or cataloging their knowledge. Well, they might be available now. If you want to know where to start, think about the things that would be most damaging to lose, the information that would be difficult to recapture. That knowledge is known only by a few and is least likely to already be captured in a systematic way as shown in the lower left corner of the diagram to the right.

In a work slowdown or stoppage, very busy people (your experts) may have some time on their hands. So, here are just three things to think about – and possibly act on – while the time and corporate will to do so is front and center. These are only

A Generic Engineering Company's Knowledge Assets

You can plot your mission-critical knowledge on a map like the one below



three activities, but they can keep your organization busy for a very long time and benefit it even longer.

1. Let this pandemic threat serve as an example to those who are advocating a knowledge management program within their company to highlight the importance of knowledge capture and ongoing learning programs.
2. For employees who may have down time or are sitting at home idled by a work stoppage, they can be enlisted to write down their job tasks and processes for future training programs.
3. Create mentor-mentee relationships between veteran and younger workers with time off so they can get to know each other via Zoom, Skype or a company platform, and give them a structured mentorship program to work through.

Software programs, learning modules and methodologies all exist to facilitate these kinds of proactive tactics to bring knowledge management to the forefront of your organization at a time when executives most certainly are worried about their business continuity plans. Even though it seems right now as if business will continue to be slow and the world has come to a halt, operations will resume normally and when they do, these opportunities may be lost as people return to the performance of everyday responsibilities. In fact, there are some classic economic models that suggest a frenzy of "pent up demand" will bring businesses back with a roar, once again pushing knowledge management to the back of the line.

We're all hoping this pandemic turns out to be a big goose egg. Should that happen, skeptics will laugh and say governments over-reacted. But for the people who heeded wise counsel to stop the potential spread of this virus, you will know that all your hard work and sacrifice made a big difference in the outcome. With healthcare workers already contracting the virus on the front-lines, it is clear this must be stopped in its tracks. In the meantime, use this time wisely to do what needs to be done during this hiatus from normal business activity.

If we stay focused on the future, when businesses are all humming along again – and they will be - you will have accomplished something of value by using this downtime to preserve the critical knowledge that makes your company unique in the marketplace. ▪

Peggy Salvatore is the author of Retaining Expert Knowledge: What to Keep in an Age of Information Overload, C&C Press, and a series of books on finding and working with subject matter experts.

Q&A

WITH LARS ROSE

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 overarching 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 talked with Lars Rose (DuPont) to learn more about his leadership on Project 268 – Guidance for Failure Mechanisms, which is being published and distributed to members in the second quarter of 2020.

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

A: I work as a Maintenance Manager for Dow and DuPont. Formerly, I worked in a global team of Materials Engineers in our plants as an Inspector and Corrosion Engineer. Due to that work, I started taking over the duties of my predecessor Frank Schramm at MTI, attending the MTI meetings at Dechema and onwards thereafter, finally becoming the co-Chair of the EuroTAC.

Q: ***Briefly give the background of Project 268 – Guidance for Failure Mechanisms. Why and how did it become an MTI project?***

A: During the MTI EuroTAC 2013, several members started the idea of pooling each other's resources to combine all the vast storage of knowledge accumulated at each MTI member company over the past decades, if not the past century, on the topic of materials failure mechanisms. It quickly became clear that a) almost each member company had their internal library for these data, and b) while most of it was aligned along the standard works out in the public literature, specific mechanisms that are not all that common may either be treated differently at different companies, or some member companies identified some benefits, for example in terms of the safety of their workforce, from additional knowledge acquired by other members. Consequently, a loose team was formed that, during a EuroTAC meeting at the University of Aachen, culminated in a project team that ended up writing a proposal to go forward with assembling a combined document of failure mechanisms. Over the course of the next two years, the actual project scope was discussed regularly until a compromise in the form of the current work was achieved. The project was granted by the MTI governing body and writing then began. Each chapter was reviewed by members of the large global team that had assembled to push this project to successful fruition.

Q: ***Why/How did you become the project champion of Guidance for Failure Mechanisms?***

A: I had written a small (100-page) document on failure mechanisms for our internal use and thus I was already interested in disseminating this information widely. It had quickly become evident that many plants lacked direct access to a trained Materials Engineer and increasing requirements by governments on predicting failure and assessing risk meant that an increasing number of chemical, petrochemical, pharmaceutical, and food processing plants has to have access to peer-reviewed, easily understandable information on failure modes and mechanisms to run their plants safely and to continue to obtain their operating permits. I thus became the figurehead of running this project and became its champion, guiding it through all phases to its successful end.

Q: ***You are an active participant in the TAC Forum, EuroTAC Meetings and MTI Projects. How have your experiences of being involved in the various aspects of MTI helped you serve as the Project 268 Champion?***

A: I am currently the co-Chair of the EuroTAC and have been involved with the organization for almost 10 years now. In the early years, participation in actual projects in EMEA was rather sparse and the EuroTAC meetings simply reviewed some of the US projects. This radically changed with a reorganization of the EuroTAC in the mid-2010s, resulting in several high-profile projects being run out of Europe, most of them spanning the years ever since. Some have stimulated project member companies to meet even outside the EuroTACs to further discuss the results of the project (such as, for example, the HTHA and SRC projects, of which I am both only a participating member). Other projects have aimed at changing ASTM standards to the level of safety they provided prior to the 2000s, especially for low-temperature carbon steel. All these activities lend themselves to participation, and so it was inevitable that I took the reigns on one of them, on a project that I had been working on professionally for many years.

Q: ***The project started in 2015. How has it evolved since then? Now that it's nearing completion, what can we expect from the final product when it's released?***

A: The official request for proposal (RFP) was filed in 2015, however, discussion of the project started long before that during the EuroTAC meetings. However, due to the large scope and the high number of member companies having very strong opinions on where this project should go, it was very important to have regular teleconferences and re-discuss the current proposals at each EuroTAC before it could even get to the RFP, much less the bidding phase. And even then, strong member participation led to the addition of some chapters, written by members of the team, and again regular meetings with our writers and supporting team members also led to some chapters being dropped in favor of topics of more interest to the chemical industry at large as well as the reviewers.

Q: ***What is the importance of the Guidance for Failure Mechanisms project and how will it benefit members and the industry?***

A: Everybody who holds this document in their hand has a solid reference, to me, that can be used to identify, predict, treat, and prevent failures in their facilities that could result from one of the almost three dozen mechanisms chosen for this book. These are not all-encompassing, and several other mechanisms exist, of course, but the major ones that may be expected at many of our plants are included. As a result, this work serves to reduce the risk of incidents and resulting personal injuries, as well as the loss of business opportunities, making the operation of chemical, petrochemical, pharmaceutical, and food/beverage industries much safer and more profitable.

Q: ***What have you learned from championing Project 268? Do you have any advice for other MTI members who might consider volunteering as a champion?***

A: There was a lot of excitement leading up to the creation of this project team, and initially, I thought that once the original set of 30 failure mechanisms proposed in this work had passed the initial team, running the project would be smooth sailing. Little had I expected more than two years of intensive and invigorating discussion just on which mechanisms to include, how to avoid duplication existing literature, what audiences to address the work to, how to set up the document, and who to involve in writing the documents. So, once the

> CONTINUED ON PAGE 25

MTI ANNOUNCES 2020 SCHOLARSHIP WINNERS

Each year, the Materials Technology Institute offers two academic scholarships for students pursuing a career in the Process Industries, and each year it seems to become more challenging to select from the qualified applicants. MTI is pleased to announce that it has chosen two more outstanding students to award the 2020 Bert Krisher Memorial Scholarship. Helen Nee, University of Akron and Will Dixon, McGill University, will each receive $5,000 toward academic expenses and the offer to attend an upcoming MTI meeting. Both students have demonstrated a strong desire to enter the industry supported by academic achievements, work experience and enthusiasm for their chosen degrees.

Will Dixon, McGill University

Will Dixon has been interested in chemistry and understanding materials for as long as he can remember. As the son of two metallurgical engineers, Dixon's parents introduced him to math and science from a young age. He's known he wanted to pursue an engineering career since childhood.

"Materials engineering attracted me because it combines physics, chemistry and math while providing students with practical tools," he explains. "I am pursuing a career in this field to solve technical challenges that help make a positive difference in the world."

He's had opportunities through several co-ops to work in the iron and steel industry, hydrometallurgical industry, nuclear industry and oil and gas industry and gain a variety of experience in engineering consulting, design, laboratory

Will Dixon

research and project proposals and evaluations. The co-ops and his university have given him the chance to work on several interesting materials-related problems as well, he notes, including: Suncor Energy (2019) – leading the trial of electroless nickel coating application on electrical submersible pump motor housing to reduce scale adhesion to motor: reducing motor operating temperature; Suncor Energy (2019) – lead destructive testing of downhole mechanical clamp equipment and revised refurbishment program accordingly; Ontario Power Generation (2018) – research and design of corrosion-protecting coatings for outdoor use on nuclear waste dry storage containers. Coatings system on container could not entrap radioactivity from water when submerged in the irradiated fuel bay; McGill University (2018) – controlled precipitation of battery-grade lithium carbonate in sulfate solution, research project was conducted in the Hydrothermal Materials for Environmental and Energy Technologies Lab (HydroMET).

Looking ahead, Dixon is finishing his last semester and has accepted a full-time position as a Hydrometallurgical Process EIT at Hatch Ltd. in Mississauga, Ontario.

"The projects I will be working on are heavily related to the production of lithium carbonate to provide the battery and electric vehicle sectors with the material required to manufacture their products," he describes. "My objective is to acquire the necessary skills to succeed in a technical business setting, and ultimately grow into a leader who can consistently deliver for both clients and my employer."

He says the MTI Scholarship is helping him get started in the right direction by covering some of the cost of tuition and offsetting some student loan pressure.

"It is an honor to be selected for this year's Bert Krisher Memorial Award. Mr. Krisher's work at Monsanto in the chemical and corrosion engineering space exemplifies truly great engineering," Dixon remarks. "His legacy continues to inspire many young engineers like myself, to do our best work and always remember to be 'one of the good guys.'"

Helen Nee, University of Akron

Helen Nee was attracted to Materials Engineering for the mere range of opportunities a career in this field could present from maintaining integrity, safety and reliability of current structures to research geared to improving materials and developing new products.

"What brought me specifically to Corrosion Engineering as a field of study was the University of Akron's

Helen Nee

Corrosion Engineering program," Nee recalls. "My interest and knowledge in material science and corrosion engineering grew through my course of studies."

Internships have largely played a part in allowing Nee to gain many different experiences. She has completed three with Marathon Petroleum and is looking forward to a fourth this summer at the Canton, Ohio refinery. So far, she says her favorite and the most interesting experience was working at the Marathon Catlettsburg Refinery.

"During my time working in the refinery, I was able to complete many corrosion damage mechanism related projects," Nee describes. "In the process of doing so, I learned about different materials and their susceptibility to failure, how to mitigate failures and implement safety practices."

The MTI Scholarship will continue to help her through her final internship and last year of education.

"I am delighted to receive the Scholarship as it recognizes my hard work and encourages me to pursue my career," she notes, concluding, "My future plans are to continue working in the oil industry after graduation. I would like to work in a refinery in an inspections department. It is important to me to use my knowledge of materials and corrosion to make the refinery a safer place for its workers, as well as one that protects the environment."

Congratulations to both Will and Helen – MTI is looking forward to seeing where your futures will take you!

MTI will offer the scholarship to undergraduate students again in 2021, and applications will be accepted beginning this fall. For more information please visit www.mti-global.org/participate/scholarships. ▪

Q&A WITH LARS ROSE

> CONTINUED FROM PAGE 23

first chapters started rolling in and the actual review of each chapter started, the work was much more what I would have expected before starting to champion this project. Having written several books both for academia and school children made it easy for me to foresee the challenges in assembling the books into one "global" format, and so the tail end work required was foreseeable and enjoyable to me. I thus hope that everybody who reads this will enjoy the work and will find it useful in their respective work.

Q: ***Just for fun, what activities/hobbies do you enjoy when you're not busy with your day job, working on MTI Projects or participating in the TAC Forum?***

A: I am involved in writing articles for the general public about engineering in a STEM outreach effort out of my native Canada called Let's Talk Science educational resources, for which I used to lead a local chapter a looooong time ago. Besides this and chairing the occasional Stainless Steel Conference, most of my time is spent with my children. I have young children, so these days, when I am lucky, they fall asleep before me. Anyway, I fall asleep at 8 pm and wake up at 4 am (without any alarm required) to do some calisthenics, HIIT (High-intensity impact training), and weightlifting. Approximately one night every couple of weeks, we get to enjoy dancing: Tarraxinha, Kizomba, Semba, UrbanKizz and the like (and try not to yawn too much while doing it, as this activity is extremely fun, but typically occurs past 8 pm).

MTI RELEASES UPDATED TAC BULLETINS

Technical Awareness 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. MTI has published 35 bulletins for members on topics from Stress Corrosion Cracking to Hot Tap Welding to Reliability of Flexible Hoses and much more. Only a select few bulletins have been made available to the public in the past; however, in 2019, the committee approved releasing bulletins to the public and will publish one to two bulletins in each issue of MTI CONNECT. They will then be made available to download on the MTI website (www.mti-global.org) for both member and public use.

Materials Technology Institute

Technical Awareness Bulletin

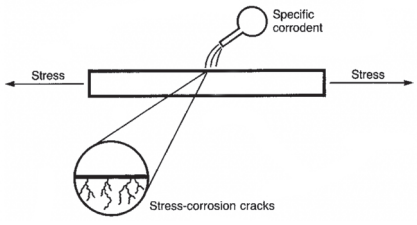
Focus on Stress Corrosion Cracking | No. 1

Introduction

Unexpected or premature failure of chemical process equipment constitutes a serious hazard in terms of safety of personnel, operating facilities, and the environment. By weakening reliability, such failures also adversely affect productivity and profitability. Modern industrial experience in chemical plants has been that failures due to environmental cracking are among the most serious of such problems, making up about 20 to 30% of all corrosion failures. The subject of stress corrosion cracking (SCC) is extensive, and the focus of this issue is to discuss in simple terms some of the pertinent information.

General Description

SCC has been defined as failure by cracking under the combined action of corrosion and typically tensile stress. The stress and corrosion components interact synergistically to produce cracks, which initiate on the surface exposed to the corrodent and propagate in response to the stress state.



For any given alloy-environment system, the engineering parameters of concern are as follows:

- Threshold stresses above which cracking occurs
- Metallurgical variables (heat treatment, structure, cold work) which render the alloy susceptible
- Environmental boundary conditions for cracking such as temperature, solution composition, pH, electrode potential, necessary impurities, etc.

It is important to realize that the conditions causing SCC may not occur during normal operation of equipment but also during startup, shutdown, idle periods, or system upsets. Stresses and environmental conditions under these circumstances can be quite different than those encountered during normal operation.

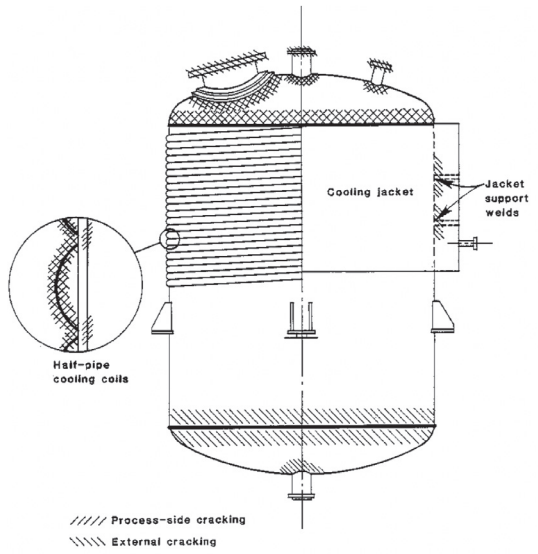
Identification

Visual identification prior to failure is difficult due to the typical tightness of stress-corrosion cracks. A low-power hand lens will greatly aid determination. Detection of cracks can be enhanced by using ultrasonic, radiographic, liquid penetrant or acoustic emission techniques.

Stress-corrosion cracks tend to branch along the metal surfaces. Typically, evidence of corrosion, such as accumulations of corrosion products, is not observed, although stains in the cracked region may be apparent. Stress-corrosion cracks tend to originate at physical discontinuities, such as pits, notches, and corners. Areas that may possess high-residual stresses, such as welds or arc strikes, are also susceptible.

Cracking Locations

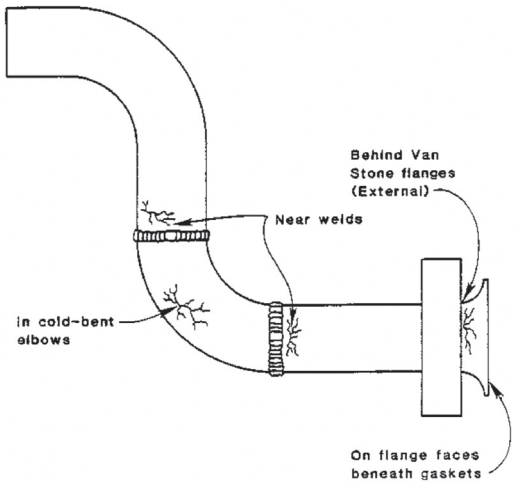
REACTORS: All weldments; circumferential welds by which nozzles are attached; radius of dished head; external jackets especially half-pipe coils.



HEAT EXCHANGERS: Weldments; nozzles; areas immediately adjacent to the tube-sheets; U-bends.

COLUMNS: Weldments, especially circumferential nozzle welds; radii of dished heads; packing (e.g. Rasching rings); expanded metal packing or mesh; trays.

PIPING: Bends; welds



Preventive Measures

There are a number of different ways to control SCC. The method used depends on the application and may involve changing the mechanical, metallurgical and environmental conditions.

Mechanical

- Avoid stress concentrators
- Relieve fabrication stresses
- Introduce surface compressive stresses
- Reduce operating stresses

Metallurgical

- Change alloy composition
- Change alloy structure
- Use metallic conversion coating

Environmental

- Modify environment
- Apply anodic or cathodic protection
- Add inhibitor
- Use organic coating
- Modify temperature

Laboratory and Plant SCC Testing

Material engineers use SCC tests for the following tasks;

- Identifying environments which cause cracking on certain materials
- Ranking materials for relative SCC resistance in certain environments
- Evaluating preventive measures.

In plant equipment, stress corrosion cracks may take years to develop. Tests which precisely duplicate the stress level, metallurgical condition and environment anticipated in the plant might therefore require months to produce meaningful results. Since engineering decisions seldom allow the luxury of such extensive test times, almost all SCC tests are accelerated in one of several ways to truncate the time to failure. Laboratory and plant SCC testing are important sources of qualitative data for materials engineers.

References: Materials Technology Institute Manuals

Reviewed/Revised 2018

Materials Technology Institute

Technical Awareness Bulletin

Coated Heat Exchanger Tubes | No. 9

Field Coating Heat Exchanger Tubes Reduces Corrosion and Fouling

Shell and tube heat exchanger tubing may suffer accelerated corrosion for many reasons, from process changes, waterside corrosion, or inadequate materials of construction.

The deposition of any undesired material on the heat transfer tubes results in fouling. Fouling may impact significantly the thermal and mechanical performance of the exchanges as it increases the overall thermal resistance and lowers the overall heat transfer coefficient of heat exchangers. Fouling also impedes fluid flow, accelerates corrosion and increases pressure drop across heat exchangers.

Although replacing tubing with an upgraded alloy is often considered the only option, a cost-effective solution may be the application of a thin polymer coating to prolong tube life, and in many cases, improve fouling resistance as well. Both OD and ID tube coating have been performed in the past; however, the most recent technology is focused on internal tube coating applications.

While the majority of users are in the power industry, where surface condenser tubes have been internally coated in the field, there are some chemical companies and oil refineries that have experience with this technology.

The majority of coating applications are with carbon steel tubes. Good coating adhesion is generally more difficult on stainless steel and brass, but experience has been reasonably good. The coating system chosen depends primarily on the operating temperature. For temperatures up to 250°F (121°C), an epoxy coating may be applied. The success of the coating depends on the internal condition of the tube (materials of construction, surface roughening due to corrosion or pitting, etc.). Even with new tubing, insufficient surface preparation, incomplete coating coverage, or inadequate coating thickness (or a combination of the three) can result in poor performance. Understandably, field applications generally on used tubing are that much more demanding.

Coating Application

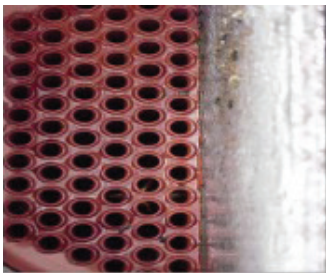
Tubes are prepared for surface preparation by various hydro blasting or abrasive blasting techniques. Coatings are atomized at 2,000-3,000 psi (13.8 – 20.7 MPa), driving the selected polymer coating material into the surface profile and covering all corrosion while completely wetting the surface in a uniform 360º hollow cone patterns. This method ensures full circumference coverage of the tube ID with coating material at a precise thickness.

Case History

A major refinery had 768 exchanger bundles of several materials of construction in cooling water service. Many of the 340 carbon steel bundles with high shell temperatures were subject to severe microbial fouling and tubeside corrosion, resulting in relatively short life. See the “before” photo below.

Uncoated Bundle After Six Months

After internally coating 209 tube bundles, leaks per month for these units fell from 6.5 to 0.3, and the mean time between replacements has risen from 2.5 years to 10+ years. Outages for cleaning and repairs have fallen from 14 per month to 4 per month. In addition, with fewer hydrocarbons in the water, the chemical treatment program was also more controllable. Refer to the “after” photo below.



Coated Bundle After Six Months

In total, the cost for coating tubes was 20–25% cheaper than alloy upgrading over the life of a bundle. No report was provided as to the effect on heat transfer efficiency by using coated tubes.

Summary

Coated tube bundles could potentially provide considerable savings on maintenance and production. In today’s market in which energy costs and alloy costs have risen sharply, the savings are likely to be even greater.

Reviewed/Revised 2018

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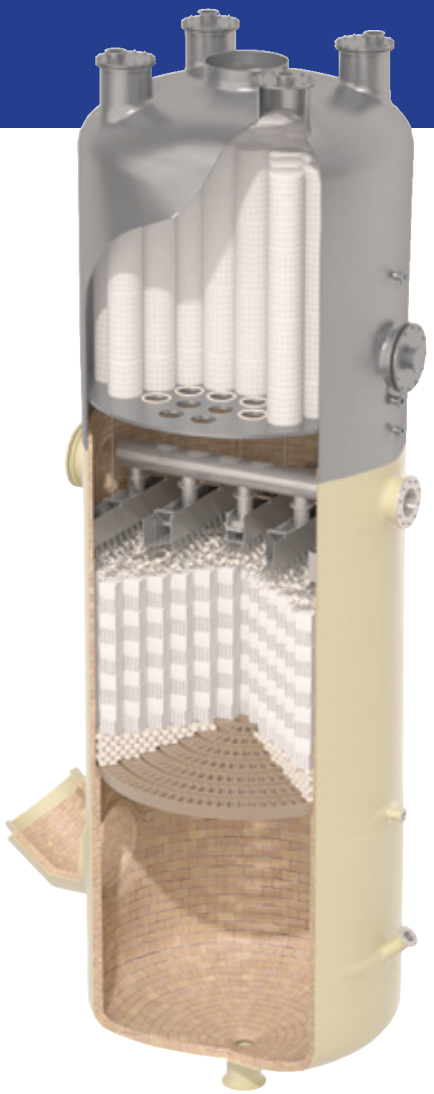

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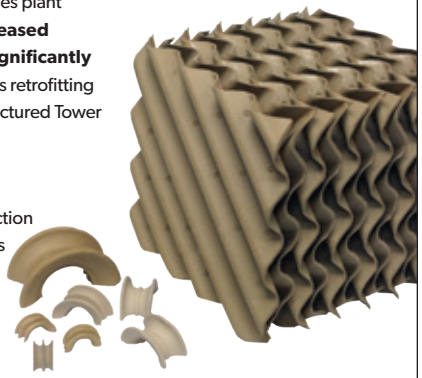

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