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thermalspray.org
Ceramic Thermal Spray: Realized Benefits Leading to Expansive Growth

By Shane Elbel

Ceramic coating on the interior of an assembled combustion chamber. (Photo by Steve Wilson, CTS.)
The heat-resistive properties of thermally sprayed ceramics inside combustors are well documented. However, ceramics can provide more than just thermal-insulative benefits. In addition to their low thermal conductivity, ceramics are stable at high temperatures, combat wear and erosion, resist electricity (electric insulator), and deter numerous types of corrosion. These characteristics have promoted technical integration into complex systems across many diverse industries. Engineers have been able to further tailor these beneficial properties through the development of new and advanced coating processes. From tiny medical devices that fit in the palm of your hand to large industrial rollers that weigh over two tons, ceramic coatings are currently being applied to a wide variety of specialized products.

Early Commercialization of Ceramic Thermal Spray Coatings

Starting in the 1960s, the demand to improve the efficiency of jet engines drove rapid innovation and commercialization of thermally sprayed ceramic coatings. These coatings have since evolved in terms of chemistry, architecture, and durability to such a degree that today many ceramic-coated products have become “prime reliant” (meaning the engines cannot operate as intended without the coating). In the early days, the commercial jet engine industry was pushing the operational thermal limits of the metals inside the engine. The need for insulative ceramic coatings was born and first utilized by Pratt & Whitney Aircraft in the combustion design of the J58 engine. Throughout the following years, several advancements in the materials and processes were recognized to support the continual increase of combustion temperatures. The low thermal conductivity of the standard thermal barrier ceramic coating, yttria-stabilized zirconia (1.1 W/m • K), was so successful at protecting combustion surfaces from overexposure to excessive heat that the coatings were subsequently introduced to the turbine section of the engine. Without the protection of these thermal barrier coatings, the metal components would rapidly oxidize and quickly degrade. With the commercialization and successful performance of thermally sprayed ceramic coatings over the following decades, other applications broadly emerged.

Corrosion and Wear Resistance

As previously mentioned, an advantageous characteristic of ceramic coatings used in industrial applications is its chemically inert behavior. Due to the passive nature of ceramics, these coatings are utilized in harsh acidic or caustic environments to protect metals from corroding. Thermal spray materials like chromium oxide and titanium oxide are commonly used as corrosion barriers in industries such as chemical processing, mining, petrochemical, paper, and valves. In applications such as on the interior of pump sleeves, ceramic coatings have been used effectively to provide wear protection when pumping highly corrosive media.

While traditional metallic hardface coatings rapidly deteriorate in these harsh environments, hard ceramics operate for years in service without fault. Historically, plating processes such as chrome plating have been utilized in wear and corrosion applications where metal-on-metal contact degrades parts quickly. However, most chrome plating can only operate in temperatures under 800°F. Also due to environmental processing concerns and
Increasing government regulations, chrome plating has fallen out of favor in many cases to ceramic thermal sprayed coatings. With the cost of corrosion in the United States estimated in the multibillions of dollars annually, the use of ceramics continues to expand. Lower operating costs and extended uptime in key commercial industries are aided by the use of thermally sprayed ceramics to help reduce chemical attack.

**Dielectric Applications**

Ceramic coatings, such as aluminum oxide and alumina titania, are commonly used because of their electrical resistivity. These types of plasma sprayed ceramics are referred to as dielectric coatings. Since a very low amount of electrical current is able to flow through ceramic thermal spray, the coating is extremely effective when used as an electrical insulator. You can find these coatings being adopted into complex circuitry, and even onto electrical connectors within the telecommunications industry. These coatings have also been employed in automotive heat sink applications for a number of years. This specific application involves applying an aluminum oxide coating on top of an electrically conductive plate. Subsequently, a coating of copper is applied on top of the aluminum oxide. After coating, heat sink circuitry is soldered directly onto the copper coating. This results in the heat sink circuit being electrically isolated from its mounting base plate due to the barrier of ceramic between the circuit and the plate.

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<th>Thermal Spray Ceramic</th>
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*Common ceramic coatings and their use in industry.*
Molten Metal

For years thermal spray coating technology has represented the gold standard within the galvanizing and aluminizing continuous strip lines across the world. An example is the high-performance roll face release coatings for molten zinc and aluminum. These engineered coatings effectively deter dross pickup within the molten metal pot, allowing for extended runs at the mills. Even after decades of success using ceramic coatings, new materials and processes are being developed with the goal of setting new records in these lines. Ceramic thermal sprayed coatings have flowed into other areas of the mill as well, as their ability to withstand the aggressive attack of molten metals while combatting excessive wear has driven increased adaptation. Continuous improvements of coatings in this market have included the experimentation and ultimate adaptation of new materials through the blending of both carbides and ceramics.

Medical Implants

One very unique application of thermally sprayed ceramic coatings has been within the biomedical field. Porous hydroxyapatite ceramics were developed for bone graft surgeries. This material, composed of calcium phosphate, promotes biocompatibility and stimulates bone growth for orthopedic implants. One of the unique benefits the plasma process provides is its repeatability, providing the same coating across thousands of production runs. These biomedical coatings are engineered to contain the proper amount of porosity to enable growing bone to permeate through the coating, thus improving the bonding of the implant over time. The thermal spray process was utilized to improve the success of these procedures. Thermal spray is also used on millions of prosthetic implants each year.

Evolving Markets

From a coating shop standpoint, the request for information on ceramic coatings dominates the types of materials being sought after by prospective customers. The benefits of these coatings continually expand as new applications are identified. Melting temperatures of ceramics exceed 3700°F. The coatings also retain tensile strengths generally higher than 5000 lb/in.², which is more than five times greater than that of traditional paint-type coatings. Thermal spray ceramics can be applied thicker than almost any other ceramic coating process, and that leads to a much longer performance life.

Conclusion

Sophisticated new thermal sprayed materials are being designed into emerging technologies. For example, solid oxide fuel cells use ceramic coatings to reduce chromium depletion from interconnects, which substantially increases energy efficiency and improves the viability of these new power sources. New rare earth oxides are being doped into legacy zirconia-based thermal sprayed ceramics to further reduce temperatures inside gas turbine engines. This enables engines to burn fuel at higher temperatures, increasing fuel efficiency and helping to reduce carbon emissions. As these examples demonstrate, ceramic coatings are a preferred enhancement used in the development of many new technologies. Thermal spray continues to be far and away the most robust and preferred method of application.

Shane Elbel (selbel@cts-inc.net) is president, Cincinnati Thermal Spray, Cincinnati, Ohio.
Guidelines for submitting a SPRAYTIME® feature article

Have you thought about writing a feature article for consideration in SPRAYTIME? If so, our staff stays on the lookout for original, noncommercial, practical, and hands-on stories. Potential ideas to focus on include a case study, recent company project, tips for handling a particular process, and so on.

Here's an easy breakdown of our guidelines:

- The text of the article should be about 1500 to 2000 words and provided in a Word document.
- Line drawings, graphs, and photos should be sent in high-resolution jpeg or tiff files with a resolution of 300 or more dots per inch.
- Plan on one figure for every 500 words, and provide captions for every image. Also, if a nice lead photo is available, please include it for review.
- The authors’ names, along with the companies they work for and their positions, should be listed.

If you’d like to discuss a particular idea or email a submission for evaluation, please contact Editor Cindy Weihl at cweihl@thermalspray.org.

NOW ACCEPTING SCHOLARSHIP APPLICATIONS

Since 1991, ITSA has provided scholarship assistance to technologists and engineers who are pursuing a postgraduate degree in either thermal spray processes (plasma, flame, arc, HVOF) or materials at an accredited United States university.

Up to three (3) scholarships $2,000.00 each
Application Deadline: July 16th, 2019

For more eligibility information or to apply, visit thermalspray.org/scholarship
AWS Unveils Centennial Celebration Web Page

As part of festivities this year for the American Welding Society’s (AWS) 100th anniversary, a special web page has been created at [aws.org/about/page/aws-100](aws.org/about/page/aws-100).

Under the headline titled “Honoring our Past, Embracing the Future,” the following is stated:

“Our Centennial celebration really belongs to all the men and women who’ve been instrumental to the Society’s growth. That’s why we’re asking all of you to join us throughout the year as we reflect on the proud heritage of service that we’ve built together and embrace the future ahead.”

The text also details AWS’s enduring mission “to advance the science and art of welding” was present at its inception in 1919, and that the Society’s dedication to helping welding professionals across the globe protect and improve lives remains as strong today as it was then.

Additionally, the web page features 100 years of AWS history in an interactive timeline. “Take a short walk down memory lane with us as we celebrate key AWS milestones along with the many significant industry advancements leading up to our 100th birthday,” is stated there.

Users can navigate through numerous accomplishments, plus view photos, all in chronological order. For example, it’s detailed that in 2011, the International Thermal Spray Association joined AWS as a Standing Committee (as seen in the above image).

As AWS marks its centennial in 2019, visit [aws.org/about/page/aws-100](aws.org/about/page/aws-100) for photos, videos, and more. Also share photos and memorabilia on social media using #AWS100.

Chemcoaters Becomes Parent Company of Eco Green Coatings

Chemcoaters, Gary, Ind., a coil coater and manufacturer of proprietary coating chemistries, now owns Eco Green Coatings, which has become a wholly owned subsidiary of the company.

Eco Green Coatings is the creator of InterReactive® coatings, and the developer of the InterCoat® Chemguard family of coatings, including a corrosion-resistant, adhesion-enhancing coating that creates a permanent covalent reaction with any zinc or zinc-alloy-coated substrate.
Bodycote, a global provider of heat treatments and specialist thermal processing services, has held an official opening ceremony at its facility on the Advanced Manufacturing Park, Rotherham, Yorkshire, UK. The heat-treatment center has been established to support the aerospace and power-generation markets in the UK and Europe.

The facility was officially opened by Andy Greasley, executive vice president of Rolls-Royce’s Turbines Supply Chain Unit, in recognition of the partnership between Bodycote and the company. Also speaking at the event, Advanced Manufacturing Research Centre CEO Colin Sirett noted the center will bring a key capability to the Advanced Manufacturing Park. “We’ve got everything from aircraft parts through to carbon fiber chassis for supercars all being manufactured on this site; the one piece of the process that was missing was materials processing,” he said.

In addition, delegates were the first to hear about Bodycote’s plans for an expansion of the new site, which includes securing extra units on the Advanced Manufacturing Park. Tom Gibbons, president of Bodycote’s Aerospace, Defence & Energy division, mentioned the additional space secured is nearly three times the size of its existing unit.
The Chinese licensee for Greenkote PLC, a global manufacturer of anticorrosion metal coatings, has won a contract to supply 1200 tons of coated hex bolts for constructing the Amur Gas Processing Plant (AGPP) in the Amur region of Siberia.

When completed, AGPP will be the second largest facility of its type in the world, designed to process 42 billion m$^3$ of gas per year. The company’s licensee, Shanghai Premier Tension Control Bolts Co. Ltd., is a joint venture of Tension Control Bolts Ltd. of the UK, Shanghai High Strength Bolts Plant Ltd., and Shanghai Yan Yan Trading.

“We’re very proud of Shanghai Premier for winning this significant contract,” said Mark Gore, Greenkote CEO. “There were six other suppliers competing, and the performance specifications for the coatings were extremely high. Because of the very harsh Siberian environment, the customer required unusually thick coatings, as well the need to pass 1000-hour salt spray testing.”

Shanghai Premier operates a complete Greenkote coating line and has added capacity to fill the AGPP contract.

Buehler Celebrates 75-Year Partnership with ASM International

Buehler, Lake Bluff, Ill., an ITW company, and ASM International, Materials Park, Ohio, are marking 75 years of continuous partnership.

Mike Keeble, Buehler’s U.S. laboratory and technology manager, and a director of the International Metallographic Society (IMS), said the following: “This longstanding partnership includes Buehler equipment at the ASM Training Center, participation on the chapter level by Buehler employees, and affiliations with the ASM Heat Treating Society, the International Metallographic Society, and the Thermal Spray Society. In addition, Buehler recognizes excellence in metallography and material science by endowing the ASM Francis F. Lucas Metallographic Award and the Jacquet Lucas Award. Our mutual investment in training laboratory technicians and custom material solutions impacts production of quality critical manufactured goods and hastens speed to market.”

ASM International presented Buehler with the 75 Years of Partnership Award.
LINE-X Picked by Military Contractor to Protect Mobile Welding Trailer

LINE-X, Huntsville, Ala., has been selected to provide its spray-on coatings to Growler Manufacturing and Engineering, Star, N.C., for use on its combat-welding trailer, the Mobile Tactical Welding Shop. This military-grade unit integrates tools and equipment in an all-terrain trailer, permitting qualified military personnel to perform electric and gas cutting, as well as welding, for maintenance or repair on vehicles and equipment in combat conditions.

Growler selected the company’s polyurea coating for the military welding trailer because one was needed that could perform at a high level in combat. The shop must also meet a wide variety of U.S. military standards, so chemical-agent-resistant coating is included. The high-build polyurea barrier coating meets the attribute requirements of chip, impact, wear, and abrasion resistances in MIL-PRF-32440B.

Chemetall Names Nexeo Solutions Distributor in North America

The surface treatment global business unit of the coatings division of BASF, New Providence, N.J., operating under the Chemetall brand, and Nexeo Solutions Inc., The Woodlands, Tex., have recently revealed a U.S.-expanded distribution relationship. This will include Chemetall’s surface treatment portfolio developed for the aerospace industry.

“The Chemetall portfolio complements our existing portfolio by adding specialty cleaners, corrosion protectants, surface preparation, and sealants, supporting our continued focus in the aerospace, military, and defense markets,” said Jason Sanchez, business director of aerospace and custom packaging at Nexeo Solutions.

BECOME A MEMBER OF THE

Your company should join the International Thermal Spray Association (ITSA) now!

ITSA is now a Standing Committee of the American Welding Society expanding the benefits of company benefits. As a company-member professional industrial association, our mission is dedicated to expanding the use of thermal spray technologies for the benefit of industry and society.

ITSA members invite your company to join us in this endeavor.

See pages 20 – 21
3rd ANNUAL ADVANCED COATINGS SYMPOSIUM
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Annual ITSA Membership Meeting
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For More Information or to Register, visit thermalspray.org/itsa-annual-meeting
Product Spotlight

LED Kit Enables Powder Coaters to Improve Quality and Reduce Waste

The Encore® nLighten™ LED kit is a fast, convenient, and safety-approved way to instantly project a powerful beam of LED light from the Encore manual spray gun. Using the kit, powder coaters benefit from reduced or eliminated rejects or rework, decreased material waste, increased efficiency, and improved safety. The light beam projected from the LED unit highlights deep recesses and cavities. Any imperfections or missed areas can be quickly identified and addressed by the operator. Optimum light levels enable precisely targeted powder application to reduce waste and save on material costs. The all-in-one application and inspection tool gives operators the power to both spray and inspect, reducing the need for post-coating quality checks. Additionally, the tool eliminates the use of unrated flashlights and other light sources that can create hazards for employees in a powder-spraying environment.

Nordson Corp.
nordson.com / (800) 433-9319

Joint Standard Provides a Guide for the Application of Thermal Spray Coatings

The AWS C2.23M/C2.23:2018, NACE NO.12, SSPC CS-23, Specification for the Application of Thermal Spray Coatings (Metallizing) of Aluminum, Zinc, and Their Alloys and Composites for the Corrosion Protection of Steel joint standard contains requirements for the application of zinc and aluminum alloys to steel substrates using thermal spray. The standard includes requirements for surface preparation, coating application, repairing coating defects, measurement of coating thickness, adhesion testing of the applied coating, and application of sealers and topcoats over the thermally sprayed metal coating. This standard is intended for use by facility owners and specifiers who develop project specifications for the application of thermally sprayed coatings for the preservation and maintenance of steel structures and components. The standard also may be used by thermal spray coating inspectors to assess the quality of surface preparation and coating application, and by thermal spray contractors to develop project work plans.

American Welding Society / NACE International / The Society for Protective Coatings (SSPC)
aws.org / (888) 935-3464; nace.org / (281) 228-6200; sspc.org / (412) 281-2331

AWS Releases 2019 Winter/Spring Products Catalog

The American Welding Society’s (AWS’s) 2019 Winter/Spring Products and Services Catalog covers publications, membership, professional and career development, expositions, academic resources, and more. The 104-page catalog highlights thermal spraying guides such as the new C2.23M/C2.23:2018, Specification for the Application of Thermal Spray Coatings (Metallizing) of Aluminum, Zinc, and Their Alloys and Composites for the Corrosion Protection of Steel; C2.16/C2.16M:2017, Guide for Thermal Spray Operator Qualification Programs; C2.18-93R, Guide for the Protection of Steel with Thermal Sprayed Coatings of Aluminum and Zinc and Their Alloys and Composites; C2.20/C2.20M:2016, Specification for Thermal Spraying Zinc Anodes on Steel Reinforced Concrete; C2.25/C2.25M:2012 (R2018), Specification for Thermal Spray Feedstock — Wire and Rods; ASM Handbook Volume 5A: Thermal Spray Technology; Thermal Spraying Practice, Theory, and Application (Historical); and more. The catalog can be accessed at the website listed below.

American Welding Society
aws.org/2019catalog / (888) 935-3464

Report Shows Growing Demand for Corrosion-Resistant Coatings

Thermal Spray Coatings Market Size, Share & Trends Analysis Report By Product, By Technology (Cold, Flame, Plasma, HVOF, Electric Arc), By Application, By Region, And Segment Forecasts, 2019–2025 has reported the global thermal spray coatings market size is anticipated to reach $14.99 billion by 2025. It is also expected to expand at a compound annual growth rate of 6.7% during the forecast period. Increasing demand from aerospace, industrial gas turbines, and a few other industries is expected to propel the growth. Growing demand for corrosion-resistant coatings from these industries is expected to be a key driver for market growth. Growing oil and gas explorations, particularly in Asia Pacific coupled with upcoming shale gas explorations across the globe, is expected to fuel demand over the forecast period. Further key findings from the report suggest aerospace application segment dominated the market in terms of revenue, with a market share of more than 32.30% in 2017, owing to the ability of thermal spray coating to provide wear and corrosion protection, low toxic gas emissions, thickness capability, and electrical resistance to the surface. Additionally, the U.S. thermal spray coatings market is anticipated to exceed $3.04 billion by 2025, owing to the presence of various manufacturers and suppliers in the country.

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For more information, visit [aws.org/ws2019](http://aws.org/ws2019)

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When it comes to welding technologies, the Shipbuilding and Aluminum industries share many of the same issues and experiences. This year, to support this synergistic relationship, these two events are being held concurrently in the same location. Attendees have the option of registering for one or both conferences.  
For more information, visit [aws.org/shipbuilding2019](http://aws.org/shipbuilding2019)

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In partnership with The Ohio State University, this 3-day seminar will focus on advanced welding and brazing, adaptive manufacturing, single crystal repair and advanced repair technologies for the aerospace and IGT engine industries.  
For more information, visit [aws.org/aerospace19](http://aws.org/aerospace19)

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For more information, visit [aws.org/inspections2020](http://aws.org/inspections2020)

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The premier event for the brazing and soldering community providing professionals, scientists and engineers a unique networking and idea-exchange forum. This conference provides cutting-edge education and technical programming, peer-networking and a full exhibit program, showcasing the latest trends, products, processes and techniques available in the industry.  
For more information, visit [aws.org/brazingcon2020](http://aws.org/brazingcon2020)
In the last issue of *SPRAYTIME*, I mentioned that ITSA was starting to plan for this year’s fall meeting and symposium. Since then, the ITSA meeting organizing committee and AWS staff have been hard at work finalizing the details.

I invite you to save the dates of October 7–10 for the ITSA Annual Business Meeting and a two-day symposium. The event will be at the MGM Grand Hotel in Springfield, Mass. The gathering will also include plant tours and meetings of the AWS C2 Thermal Spray Standards sub and main committees.

This year’s symposium will focus on aerospace applications. Experts in the field will present and discuss advances in hot applications, wear resistance and clearance control, repair, and other coatings on aerospace-related components. Although these applications may be related to aerospace, they are often transferred to other industries, such as power generation, oil and gas, general protection, and repair. There should be something for everyone in the industry to learn and associate with.

The event will also host tabletop displays for vendors and attendees. There will be opportunities to network and meet new people and companies in a casual environment.

We are still looking for quality presentations to fill out our program. If you are interested in presenting or know someone who should speak at our event, please contact ITSA Program Manager Alfred Nieves at ITSA@thermalspray.org. We would like to speak to those interested; however, the program will be established soon, so don’t wait!

**ITSA MISSION STATEMENT**

The International Thermal Spray Association, a standing committee of the American Welding Society, is a professional industrial organization dedicated to expanding the use of thermal spray technologies for the benefit of industry and society. ITSA invites all interested companies to talk with our officers and company representatives to better understand member benefits.

**OFFICERS**

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Vice-Chairman: Ana Duminie, North American Höganäs

**EXECUTIVE COMMITTEE**

(above officers plus the following)

Jim Ryan, TechMet Alloys
Dan Hayden, Hayden Corp.
Bill Mosier, Polymet Corp.
Peter Ruggiero, Curtiss-Wright Surface Technologies

**ITSA MEMBER NEWS**

**Tradeshow Assessment for ITSA Members Eliminated**

ITSA Members were invited to participate in the ITSA Member Satisfaction Survey, in which they were asked to rate the value of various member benefits. Based on feedback received on the value of ITSA Booth participation at industry tradeshows, at its April 20, 2016, meeting, the ITSA Executive Committee unanimously decided to discontinue ITSA booth activity at tradeshows effective July 2016. As ITSA Members subsidized the cost of ITSA booth activity via annual assessments, this move will result in the elimination of these costly annual ITSA Member assessments going forward.

In lieu of booth representation at tradeshows, ITSA will proactively participate in alternative ways at key industry events. For example, a series of educational presentations promoting thermal spray are being scheduled as free, half-day sessions at tradeshows like FABTECH, POWER-GEN International, and CORROSION.

**ITSA SCHOLARSHIP OPPORTUNITIES**

The International Thermal Spray Association offers annual graduate scholarships. Since 1992, the ITSA scholarship program has contributed to the growth of the thermal spray community, especially in the development of new technologists and engineers. ITSA is very proud of this education partnership and encourages all eligible participants to apply. Please visit thermalspray.org for criteria information and a printable application form.

**ITSA THERMAL SPRAY HISTORICAL COLLECTION**

In April 2000, the International Thermal Spray Association announced the establishment of a Thermal Spray Historical Collection that is now on display at the State University of New York at Stony Brook in the Thermal Spray Research Center, USA. Growing in size and value, there are now more than 30 different spray guns and miscellaneous equipment, a variety of spray gun manuals, hundreds of photographs, and several historic thermal spray publications and reference books. Future plans include a virtual tour of the collection on the ITSA website for the entire global community to visit. This is a worldwide industry collection, and we welcome donations from the entire thermal spray community.

**ITSA SPRAYTIME**

Since 1992, the International Thermal Spray Association has been publishing *SPRAYTIME* for the thermal spray industry. The mission is to be the flagship thermal spray industry publication providing company, event, people, product, research, and membership news of interest to the thermal spray community.
JOIN THE INTERNATIONAL THERMAL SPRAY ASSOCIATION

ITSA is a professional, industrial association dedicated to expanding the use of thermal spray technologies for the benefit of industry and society. ITSA Membership is open to companies involved in all facets of the industry — equipment and materials suppliers, job shops, in-house facilities, educational institutions, industry consultants, and others.

Engage with dozens of like-minded industry professionals at the Annual ITSA Membership Meeting, where there’s ample time for business and personal discussions. Learn about industry advancements through the one-day technical program, participate in the half-day business meeting, and enjoy your peers in a relaxed atmosphere complete with fun social events.

Build awareness of your company and its products and services through valuable promotional opportunities — a centerfold listing in the SPRAYTIME Newsletter, exposure on the ITSA website, and recognition at industry trade shows.

Plus, ITSA Membership comes with an American Welding Society (AWS) Supporting Company Membership and up to five AWS Individual Memberships to give to your best employees, colleagues, or customers. Visit aws.org/membership/supportingcompany for a complete listing of additional AWS benefits.

For more information, contact Alfred Nieves at 800.443.9353, ext. 467, or itsa@thermalspray.org. For an ITSA Membership Application, visit the membership section at thermalspray.org.
Höganäs Adds President, Product Area Surface & Joining Technologies

Höganäs, Höganäs, Sweden, has added Hans Keller as president, product area surface & joining technologies. In this position, Keller will drive the company’s product and application developments within the technology areas of surface coating, brazing, and welding. He started his career at H. C. Starck and held various leading positions in the company until he joined Oerlikon Metco in 2012. In 2018, Höganäs acquired the Surface Technology and Ceramic Powders division from H. C. Starck, which Keller will now assume responsibility for. “Hans brings with him a deep and broad experience from the business, which will be paramount for Höganäs, now that we have set an ambitious growth and development agenda, not least for product area surface and joining technologies,” said Fredrik Emilson, Höganäs CEO.

CenterLine Promotes Marketing VP; Welcomes Marketing Manager

CenterLine (Windsor) Ltd., Windsor, Ontario, Canada, has appointed Phil Campbell as vice president, global sales and marketing; and Kathleen Cvitkovic as corporate marketing manager.

In his new role, Campbell will continue to support the company sales organization and clientele, while collaborating with the CenterLine Global Affiliates to grow their business with shared global customers in their respective international regions. Campbell developed extensive business management experiences as the past president of Axiom Technologies Ltd., prior to joining CenterLine in 2007 as vice president of sales and marketing. He has 33 years of sales and sales management experience and a strong commitment to customer service and corporate relations. In addition, he is a certified engineering technologist and a member in good standing with the Ontario Association of Certified Engineering Technicians and Technologists.

Cvitkovic joins the company as corporate marketing manager, where she will report to Campbell and be responsible for managing all aspects of the company’s marketing initiatives. Prior to joining CenterLine, she focused on the development, implementation, and management of comprehensive marketing campaigns that integrated branding, content creation, public relations, social media, conferences, and more.

OBITUARY

C. Michael Ellison, president and chief executive officer of The Ellison Group, passed away on September 20, 2018. He was 63. Born in Cincinnati, Ohio, he attended the University of Cincinnati where he obtained a bachelor of science in chemistry. In 1986, he founded Ellison Surface Technologies in Hebron, Ky., which remains the company’s flagship manufacturing facility, specializing in thermal spray coatings and other related special processes. Ellison led The Ellison Group throughout its history, growing and expanding capabilities in many emerging technology areas, such as Accelerated Technologies Inc., which was an early leader in rapid prototyping and 3D-printing technologies. In 1997, he opened the company’s second facility in North Clarendon, Vt., to provide thermal spray coatings for GE Aviation’s Rutland, Vt., facility. The company expanded internationally to Bromont, Quebec, Canada, in 2012 and into the developing aerospace market in Guaymas, Sonora, Mexico, in 2013. Ellison Surface Technologies, Mexico, became the first, and remains the only, NADCAP Coatings approved supplier in Mexico. Throughout his professional career, Ellison served on many boards devoted to Christian ministries including Back2Back Ministries, Athletes in Action, and business boards such as U.S. Plastics Corp. of Lima, Ohio. He is survived by his wife and four sons. His oldest son, Andrew, has assumed the role of chief executive officer of The Ellison Group.

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  July 14–20 / Grenada, Spain  
  compositesworld.com/events

SEPTEMBER 2019

- **POWERGEN Asia**  
  September 3–5 / Kuala Lumpur, Malaysia  
  powergenasia.com

- **EUROCORR 2019**  
  September 8–13 / Seville, Spain  
  efcweb.org

- **Turbomachinery & Pump Symposium**  
  September 10–12 / Houston, TX  
  tps.tamu.edu

- **Thermal Spray of Suspensions & Solutions Symposium**  
  September 17, 18 / Boucherville, QC  
  asminternational.org

- **Materials Science & Technology (MS&T19)**  
  September 29–October 3 / Portland, OR  
  matscitech.org

OCTOBER 2019

- **ITSA Annual Meeting and Symposium**  
  October 7–10 / Springfield, MA  
  thermalspray.org

- **Heat Treat 2019**  
  October 15–17 / Detroit, MI  
  asminternational.org/web/heat-treat-2019

- **2019 PM Management Summit**  
  October 26–29 / Miami, FL  
  mpif.org

NOVEMBER 2019

- **ISTFA 2019**  
  November 10–14 / Portland, OR  
  istfa.com

- **FABTECH**  
  November 11–14 / Chicago, IL  
  fabtechexpo.com

- **POWER-GEN International**  
  November 19–21 / New Orleans, LA  
  power-gen.com

DECEMBER 2019

- **ASM Global Materials Summit**  
  December 3–5 / Marco Island, FL  
  asminternational.org/web/asm-global-materials-summit

MARCH 2020

- **CORROSION 2020**  
  March 15–19 / Houston, TX  
  nacecorrosion.org

MAY 2020

- **FABTECH MEXICO**  
  May 12–14 / Mexico City, Mexico  
  mexico.fabtechexpo.com

JUNE 2020

- **ITSC 2020**  
  June 10–12 / Vienna, Austria  
  asminternational.org/web/itsc/home

- **FABTECH Canada**  
  June 16–18 / Toronto, Canada  
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