Thermal Spray Specifications and Verification
Scholarship Recipients Show Promising Future
MEC offers all kind of Thermal Spray Systems/Guns & Shot Peening Machines

ROBOTIC 8-AXES CLOSED LOOP CONTROLLED MULTI PROCESS TURNKEY SYSTEM

ROBOTIC & CNC SHOT PEENING/GRIT BLASTING MACHINES

METALLIZING EQUIPMENT CO. PVT. LTD.
sales@mecpl.com, marketing@mecpl.com, trade@mecpl.com
Web: www.mecpl.com
## Features

Ensuring Durability — Specifying Criteria for Harsh Service Overlays ......................................................... 4

ITSA Scholarship Winners Eager to Make Big Contributions to the Future of Thermal Spray .............................. 8

## Departments

Industry News ...................................................................................................................................................... 11

Product Spotlight .............................................................................................................................................. 14

ITSA Welcomes New Members ...................................................................................................................... 15

ITSA Member News ......................................................................................................................................... 16

People in the News ......................................................................................................................................... 18

ITSA Membership .......................................................................................................................................... 20

Calendar ........................................................................................................................................................... 22

---

Published by International Thermal Spray Association, A Standing Committee of the American Welding Society

**Mission:** To be the flagship thermal spray industry publication providing company, event, product, research, and membership news of interest to industrial leaders, engineers, researchers, scholars, policymakers, and the public thermal spray community.

**OFFICERS**

Chairman: David Lee, Kennametal Stellite Company

Vice-Chairman: Ana Duminie, North American Höganäs

**EXECUTIVE COMMITTEE** (above officers plus the following)

Jim Ryan, TechMet Alloys

Dan Hayden, Hayden Corporation

Bill Mosier, Polymet Corporation

Peter Ruggiero, Curtiss-Wright Surface Technologies

**SPRAYTIME®**

Publisher Mary Ruth Johnsen

Editor Cindy Weihl

**SPRAYTIME® Editorial Staff**

Kristin Campbell Katie Pacheco Roline Pascal

Technical Editor Daniel Hayden

Designer Willie Chinn

Advertising Kim Daniele

---

SPRAYTIME® (ISSN 1532-9585) is a quarterly publication of the International Thermal Spray Association. Printed on Recycled Paper. Copyright© 2019 by the International Thermal Spray Association. Starred (*) items excluded from copyright. The International Thermal Spray Association is not responsible for the accuracy of information in the editorial, articles, and advertising sections of this publication. Readers should independently evaluate the accuracy of any statement in the editorial, articles, and advertising sections of this publication that are important to him/her and rely on his/her independent evaluation.

Article submissions (subject to acceptance and edit), advertising insertions, address correspondence, subscription request, back issue copies, and changes of address should be sent to:

**American Welding Society**

Attn: SPRAYTIME

8669 NW 36 Street, #130, Miami, Florida 33166-6672

Phone: 800-443-9353 or 305-443-9353 | spraytime.org

A subscription to SPRAYTIME® is free for individuals interested in the thermal spray and coatings industry. Visit spraytime.org to subscribe.
Ensuring Durability — Specifying Criteria for Harsh Service Overlays

By Daniel Hayden

The growing use of specifications and the expanding adoption of quality management systems has generally improved both customer satisfaction and the bottom line for applicators of thermal spray coatings across a variety of industries and applications. Customers are more accurate in their requests, certain about the nature of the coating applied, and shops are less likely to see a job return for rework because of an improper application. As customers increasingly attempt to develop and use specifications for their orders, however, thermal spray applicators are seeing an increase in specifications that are incomplete, inappropriate for the application, or are simply too stringent to meet the desired production cost and delivery. The reasons are various and understandable, and a partly usable specification is often better than none. The intent of this article is to help purchasers and applicators agree from the outset on a definition of work scope and acceptance that is correct for the application.

A well-written specification clearly defines the coating being requested, its nature, and its dimensions. In addition, it clearly establishes the metrics that will be used to accept or reject the product upon completion. If the request is too vague, the applicator can reasonably claim the product is as requested even though the customer may not be satisfied with the result. If the acceptance criteria is too stringent, it may be impossible for the applicator to consistently meet the requirements throughout the scope of the contract. The aim, therefore, is to ensure the purchaser is asking for the right coating, and the acceptance criteria is reasonable for that material and process.

Coating Selection

To the first aim, it is sometimes the case that the coating vendor is more familiar with a coating’s capabilities than the specifier, and so it is often helpful if the function of the coating is well established from the outset. What is the operating environment? What is the nature of the wear or corrosion that the coating will address? What complicating factors exist? The answers to these questions define the coating material best suited to the application, the dimensions of the coated area and the nature of its boundaries, and the stringency of the process used to apply it. If an applicator can participate in this phase of the specification’s development, the chance of a successful outcome is much improved because the choices will be made with the applicator’s abilities (and knowledge of coating behavior) in mind.

Measuring and Accepting

For thermal sprayed coatings, there are only a few fundamental categories of coating features that most shops can measure effectively: hardness, roughness, adhesion, microstructure, and chemistry. In addition to dimension (thickness and location), some
or all of these forms the backbone of most specifications. Within each category, there are options for the type and specificity of the testing, some with far greater cost and time requirements than others, and there are target values and acceptable ranges for those values. The selection of the “right” test and the limits for acceptance can have tremendous impacts on the odds (and time and cost) of meeting those requirements.

Hardness

Hardness is perhaps one of the most common desirable features of a sprayed coating, whether it is applying a hard coating to improve durability of a surface or a soft coating to improve surface lubricity. Verifying the coating’s hardness is often a fundamental test for its acceptance. In addition to validating the material’s makeup, hardness is also directly affected by porosity, and an underlimit hardness value can quickly highlight an issue with the coating’s microstructure that may require more intensive investigation to verify. Coating hardness is typically measured in one of two ways: by superficial hardness according to ASTM E18, Standard Test Methods for Rockwell Hardness of Metallic Materials, or by microhardness according to ASTM E384, Standard Test Method for Microindentation Hardness of Materials. Both are indentation methods, meaning they measure the depth of penetration of a known load and shape into the coating. Superficial hardness can be done quickly with minimal sample preparation and can provide results within a few minutes. Microhardness requires mounting and polishing a portion of the coated specimen for evaluation under a microscope, a process that can take an hour or more, during which time work is often not able to proceed. Though the test is more time consuming, it is also more precise than superficial hardness and is the only option for very hard or very thin coatings (typically less than 0.015 in.). Values for most coatings are available from coating material suppliers and coating vendors, and acceptance limits that exceed the commonly published data may be difficult to attain consistently.

Other tests of coating hardness and resistance to wear that better simulate the actual wear condition for which the coating is being used have been developed. In cases where wear is the primary motivation for using a hard coating such tests as the ASTM G65 abrasive wear test, Taber abrasion, pin-on-vee, and block on ring may prove even more useful for assessing coating performance; however, they are not as common or readily available at most spray shops. An even more appropriate evaluation of coating wear resistance may be abrasive grinding, which is often already a part of post-coating finishing. In applications where coatings are to be ground after application, the ease or difficulty in grinding (as gauged by the time required) and the resulting surface finish are often a more immediate measure of coating hardness, integrity, and durability than any mechanical test performed on a sample.

Surface Finishing

Like hardness, surface finish is a highly process-dependent and sensitive measure of coating consistency. It will vary in proportion to coating porosity, as well as with particle velocity, cooling, standoff, and other critical spray process parameters. While roughness is most often defined as an acceptance criterion for the coating’s end function, its susceptibility to variation can make it a worthwhile and easy-to-measure factor even for as-sprayed coatings. Roughness is typically measured by a stylus profilometer, a quick and easy test that requires minimal sample preparation. However, the value obtained is also affected by the profilometer’s settings, especially its sampling stroke length. If the coating vendor and the customer are measuring coating roughness without ensuring equipment settings and measurement technique are similar, both may get very different results on the same coating.
Profilometry

As with hardness, other testing methods and means of evaluation have been developed. Laser and optical profilometry can eliminate the variability of the equipment and “feel factor” imparted by the inspector. Here, too, a practical test of the finished product may be a faster and more reliable measure of the coating’s nature. For example, “bubble testing” a ground and lapped ball valve and seat can reveal imperfections in surface roughness and structure that would be very difficult to identify with traditional profilometry.

Microstructural Evaluation

Microstructural evaluation, examination of the actual internal makeup of the coating cross section, can make apparent defects that are not easily observable by other means. These defects include cracking and separation within the coating, percentage of oxidized material, contamination of the substrate interface, and porosity. Of these, porosity, or the amount of open space within the coating cross section, is the most common quality assurance metric. It can be an indicator of deficient spray parameters that fail to produce enough energy to properly densify the coating on impact, and more importantly, can be a sign that the coating lacks sufficient mechanical integrity for the application. Like microhardness, microstructural evaluation requires mounting and polishing of a coated specimen, which takes time and effort. And though porosity can be assessed by other means, microscopic evaluation is the best method for quickly assessing a variety of structural properties at once.

Much of the work of microstructural assessment is done visually, via a trained metallographer, and often using comparison with visual reference photographic standards. However, in the effort to improve, automate, and more accurately quantify the results, all sorts of advanced techniques have been introduced, including computerized image analysis, mercury intrusion porosimetry, and computed tomography (CT) scanning. Each of these replaces the rough visual estimate made by a skilled operator with a hard number generated by one system or another. If several properties must be evaluated quickly, and especially if microhardness is to be part of the acceptance criteria, visual evaluation of a sectioned and polished mount may ultimately be the fastest and easiest route to the result. The more important factor in establishing these criteria as part of the product acceptance, due to the time and cost of their evaluation, is whether porosity, microhardness, oxide content, etc., as measured by microscopy will have any meaningful impact on the performance of the coating in service. If the information gained from sectioning, mounting, and polishing a specimen will add little to the understanding of the product quality than simpler and faster tests, the savings in time, effort, and material might be much appreciated.

Coating Adhesion Testing

Coating adhesion testing, often called tensile testing, is most commonly evaluated according to ASTM C633, Standard Test Method for Adhesion or Cohesion Strength of Thermal Spray Coatings, whereby the thermal spray coating is applied to one end of a 1-in.-diameter metal slug. A second slug is glued to the coating face, and the two slugs are pulled apart in a standard universal testing machine. The failure load, at which the slugs separate, creates a quantifiable metric that indicates, more or less, how tightly the coating is adhered to the substrate and to itself.

Because thermal spray coatings are inherently mechanically bonded, their mechanical bond strength is a meaningful indication of coating integrity. However, several factors can adversely affect the results of this test. Among these are the quality and application of the adhesive used, alignment of the mating slugs, coating thickness, and subjective assessment of the failure modality. In addition, the coating and preparation of the slugs require a fair amount of spray time and material, as well as cure time and cooling of the adhesive. Compromise in these many factors often means discarding data outliers and allowing sufficient tolerance in the acceptance criteria that a rejection will only occur if the coating is grossly out of specification.

Alternative Tests

While there are not several high-tech alternatives to traditional bond testing the way there are with other coating features, there are faster and, one might say, more crude alternatives that might just as suitably indicate a functional and acceptable coating. Bend testing is one such test. A specified thickness of coating is applied to a thin (e.g., 0.060 in.) metal coupon, which is then bent around a mandrel of a specified diameter. The coating is then evaluated for the amount and extent of cracking and spallation that occurs around the bend; the less
spray, the better. Unlike the ASTM test, there is no need for adhesive curing, saving time and reducing error. The coating thickness on the coupon is often much lower, saving spray time and material, and the time needed for the test is much reduced. It is also a “worst case scenario” for any coating and may give a substantial sense of assurance to the end user of the coating’s resilience.

Finally, actual coating composition shouldn’t be overlooked. Positive material identification by x-ray diffraction, inductively coupled plasma, or spark emission spectrography can quickly confirm that the coating on the part (or the coupon) is the coating that was ordered. And, while this may seem excessive or redundant, most metallic thermal spray coatings will look very similar, hardness and porosity can be nearly identical for many common alloys, and yet alloy composition can drastically affect coating performance in service. A fast test with a handheld device verifies that the correct bottle was pulled from the crib, or that the right gray powder was put in the bottle to begin with. In addition, it is often a simple matter to provide the manufacturer’s certification of conformance for the bottle (or spool) and lot of material used, and many quality management systems will require the exchange of material certifications.

**Specification and Verification**

Specification and verification, in general, may appear to be onerous and unnecessary in a market where blueprint notes had previously been enough. Why is it necessary to say more than “tungsten carbide high-velocity oxygen fuel (HVOF) 0.015 to 0.018 in.,” and have faith that that will be provided? Return to the original premise that a good specification will define both exactly what is needed and exactly how to verify that this was provided.

Let’s consider the example drawing note above, which is not unusual for a large roller in a paper mill. Given this information and no more, a coating vendor might apply an equally common 88/12 tungsten carbide cobalt, choosing to measure the thickness with an eddy current gauge at five locations along the roller’s face. Without context, the coating vendor has met the requirement. However, if the roller is to be ground after coating, the coarse carbide used may not yield a low enough Ra after grinding to meet the ground finish requirement. If the roll grinder discovers the total indicator runout to be greater than 0.004 in., the coating may also not be of sufficient thickness after grinding. And, if the mill’s water content or washdown may cause the cobalt to leach out of the coating, leading to staining of the roll and sheet and premature failure of the coating. It may seem to be an extreme case, but it is not so uncommon. A careful discussion of the roll’s needs beforehand could avert premature outage at the mill, stripping and re-grinding, recoating with a fine WC/NiCr or 86-10-4 WCoCr, second final grind and superfinishing, not to mention shipping costs and delays.

Even in the mature and highly specified turbine market, specification problems exist. Blueprints with latent, unrevised callouts leave nominal 125-Ra tool finish requirements on as-coated surfaces, heavy weld overlay thickness requirements on HVOF coated zones, and plasma spray visual standards applied to HVOF coating specifications. If the information is copied without checking or revision into future generations of documents, the impossible to achieve becomes the de facto standard countless shops are required to meet. If the work is performed at a reputable coating facility with an established and functioning quality management system, production, engineering, and quality will be locked in a battle to make parts that meet the specification while precious hours are bled out of the customer’s lead time. Even in cases where the specification is manageable, an over-engineered document can add complexity, cost, and delay into a schedule at the least convenient phase of manufacturing. Coating, after all, is often one of the last operations before delivery.

**Conclusion**

A well-crafted specification ensures the purchaser knows what is being purchased and the vendor knows exactly what to provide. If the document was created with a sound understanding of the requirements of the application and the capabilities of the coating, the application will be simple and cost effective to perform and will meet or exceed the expected performance. Thermal spray coatings have the potential to significantly improve the life and function of equipment throughout industry. Specification has the potential to minimize bad experiences with the technology, but, as with any endeavor, overregulation can easily sink it.

**Daniel Hayden** (danielhayden@haydencorp.com) is president, Hayden Corp.
ITSA Scholarship Winners Eager to Make Big Contributions to the Future of Thermal Spray

By Cindy Weihl

For more than 25 years, the International Thermal Spray Association (ITSA) Scholarship Program has contributed to the growth of the thermal spray community. Three PhD candidates were selected last year to each receive $2000 scholarships to help fund their postgraduate education. Hugo Caouette-Fritsch from the University of Toronto, Edward Gildersleeve from Stony Brook University, and Milad Rezvani Rad from the University of Alberta were the 2018 ITSA scholarship recipients.

Fig. 1 — Hugo Caouette-Fritsch is currently a student at the University of Toronto where he is conducting research on solution precursor plasma spray.

Hugo Caouette-Fritsch

While interning at Pratt & Whitney Canada in Montreal in 2014, Hugo Caouette-Fritsch was introduced to industrial thermal spray coatings. In charge of conducting microstructure analysis of newly developed plasma spray and cold spray coatings, and helping to troubleshoot the plasma torch and booth, Caouette-Fritsch’s interest in the thermal spray industry was sparked.

“Thermal spray is a highly interesting technology to me because it involves high temperature additive manufacturing of metallic and ceramic materials. Additionally, the technology is growing at a rapid pace and can be used in a myriad of applications,” he explained.

Currently a PhD student at the University of Toronto and set to graduate in September, Caouette-Fritsch said the ITSA scholarship has alleviated a portion of the financial burden acquired from graduate school, which in turn allowed him to dedicate more hours to research and development in the laboratory — Fig. 1.

“In the past year, I have been developing molybdenum graphite supercapacitor electrodes using solution precursor plasma spray. Once manufactured, I heat treat the electrodes in ammonia gas, and subsequently test their electrochemical properties using a potentiostat. I am seeking to understand how the plasma spray conditions (amperage, gas, composition, etc.) effect the electrode’s microstructure, composition, and electrochemical performance,” he said.

Upon graduating in September, Caouette-Fritsch plans to join the petrochemical industry as a materials engineer.

“I will be responsible for developing strategies to improve the plant’s reliability and reduce cost,” he said.

Caouette-Fritsch says he is enthusiastic about the job opportunity because it will require both scientific and financial acumen.

Edward Gildersleeve

Edward Gildersleeve takes pride in being a graduate student pursing a doctorate at the Center for Thermal Spray Research at Stony Brook University — Fig. 2.

His research as a PhD student is focused mainly on coating systems for aero- and land-based turbine engines. He has spent the majority of his time thus far examining Yttria Stabilized Zirconia (YSZ) coatings and nuances in its properties.

“Thermal spray is an amazing field of study. It is a field which is both old and new; it amazes me to know the technology has been around for decades, yet each day scientists and researchers are making strides toward establishing new understanding and methods to incorporate more predictability and control into the process,” he said.

Gildersleeve credits his time as an undergraduate research aide at the Center for Thermal Spray Research as being both eye opening and life changing. It was there that his interest in scientific research and thermal spray peaked.

“It is a common cliché said by Confucius long ago ‘choose a job you love, and you will never have to work a day in your life.’ As a teenager or young adult, it is not easy to truly grasp such a profound concept; some people search their whole lives trying to achieve this. I am fortunate at my age to be able to say that as a PhD student at the Center for Thermal Spray Research, I believe I have found such a sense of purpose and belonging,” he said.
Gildersleeve is open to either a position in the industry or further into academia upon his graduation in May of 2020. He believes it is up to his generation to maintain the current academic base while also inspiring new researchers.

“If you’re thinking of getting involved in the thermal spray industry, go for it! There’s no substitute for hands-on experience and getting your hands dirty in the field. It’s a field with challenges but equal weight in rewards. Thermal spray will teach you to think on your feet while also allowing you to express yourself creatively through your research,” he concluded.

Milad Rezvani Rad

Milad Rezvani Rad was born in Iran, where he first obtained a bachelor of science degree in mechanical engineering before being accepted into the most prestigious engineering school in the country, Sharif University of Technology.

His interest in thermal spray research blossomed as an undergraduate student but grew while working on his master’s degree.

“I found the material science course very interesting and useful. Since I have always wanted to create something, I realized that the field of additive manufacturing in general can be a perfect fit,” he said.

While at Sharif, Rezvani Rad became further exposed to the thermal spray field. He gradually became aware of the many applications for thermal-sprayed coatings in the industry and his interest continued to grow.

“The very challenging part in thermal spray, in my opinion, is the many aspects, factors, and parameters that one should consider to obtain favorable results. Based on experience, I have noticed that even the seemingly negligible parameters sometimes have a noticeable impact on the microstructure of the developed spray coatings, their functionality, and the resulting performance,” he said.

Rezvani Rad is currently employed at the University of Alberta in Edmonton, Canada, as a graduate research assistant — Fig. 3. He will graduate from the university in December and hopes to then find a post-doctoral fellowship position in a prestigious research lab. His long-term goal is to become a university professor and stay in the academic world.

“The need for using thermal sprayed coatings in industrial applications is growing at an ever-increasing rate. This is mainly due to the requirements of the market to utilize more efficient coatings with new capabilities. Therefore, more research is needed to be done to further improve the current coatings systems in terms of functionality and cost. This has created an unparalleled opportunity for the researchers in this field around the world,” added Rezvani Rad.

Conclusion

“The thermal spray coating industry is growing steadily with opportunities in many segments such as aerospace, energy, biomedical, and marine. To keep up with the growth, companies (big and small) need excited and innovative young minds who can use thermal spray coatings to solve problems and create process improvements. ITSA is proud to support a scholarship program for enthusiastic students who are considering careers in thermal spray coatings. These scholarships are truly an investment in ‘tomorrow,’” said ITSA Scholarship Committee Chair Tim Connelly.

Please visit thermalspray.org for scholarships criteria information and a printable application form.

Cindy Weihl (cweihl@thermalspray.org) is the editor of SPRAYTIME®.
SCHOLARSHIP OPPORTUNITIES

International Thermal Spray Association

Up to three (3) Graduate scholarships worth $2,000.00 each to be awarded each calendar year.

Since 1991, the ITSA Scholarship Program has contributed to the growth of the thermal spray community, especially the development of new technologists and engineers. The International Thermal Spray Association is very proud of this education partnership and encourages all eligible participants to apply.

NEW APPLICATION DATES:

Scholarship applications are now accepted annually July 16th deadline ONLY for the Graduate scholarships.

Please visit the Scholarship area at thermalspray.org

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.
Hayden Corp. Marks 100-Year Milestone

Hayden Corp., West Springfield, Mass., a thermal spray and laser cladding services provider, is celebrating its 100-year anniversary.

Hayden Wire Works opened in 1919, serving the booming paper industry. Over the next several decades, the company would pioneer metallizing solutions for paper mill machinery, eventually developing thermal spray processes in the 1960s. As time moved forward, the company grew, offering coating services to new industries. In 2008, it added laser cladding services. Today, Hayden serves users in dozens of industries.

The company will segue into 2019 by implementing a new job tracking system, renewing its National Aerospace and Defense Contractors Accreditation Program (NADCAP) certification, and adding grinding to its Federal Aviation Administration (FAA) approved offerings for users in the aerospace industry.

The job tracking system will automate the request-for-quote process. All order-handling entries will then be automated through haydencorp.com. This operation will mean faster response time, and overall faster job completion, from quote request to completion.

“Turnaround time is incredibly important to our customers. In many cases, their productivity and profitability depends on it,” said Hayden Corp. President Daniel Hayden. “We pride ourselves on being an advantageous strategic partner for coatings services, and automating more of our processes will only make us more efficient.”

In addition, the company is in the process of finalizing its NADCAP recertification for the following services: AMS2437 (plasma spray) and AMS2447 (high-velocity oxyfuel). It has also been granted approval to provide grinding as part of its laser cladding services offered as an FAA-approved repair station.

Public Review Period Open for Thermal Spray Specification

Draft #1 of a proposed revision to the joint standard SSPC-CS 23.00/AWS C.2.23/NACE No. 12, Specification for the Application of Thermal Spray Coatings (Metallizing) of Aluminum, Zinc, and Their Alloys and Composites for the Corrosion Protection of Steel, was issued for consensus committee ballot by The Society for Protective Coatings (SSPC), NACE International, and the American Welding Society (AWS) in early January 2019.

Interested stakeholders, especially those in the general-interest category who neither apply nor specify thermal spray coatings, may contact Aimée Beggs, standards development specialist, at beggs@sspc.org to obtain a copy of the draft for review purposes.

Comments should be received no later than March 4, 2019, and sent to Beggs using “Draft #1 SSPC/AWS/NACE Thermal Spray Standard 2019” as the email subject line.
Airborne Maintenance Earns FAA Approval

Airborne Maintenance & Engineering Services, Wilmington, Ohio, has received Federal Aviation Administration (FAA) approval of repair specifications for selected aircraft parts using supersonic particle deposition, commonly known as cold spray.

“This groundbreaking approval is the first step in making the cold spray process commercially available for use in aircraft repairs, and it opens opportunities to seek approval for repairs of aircraft parts that are not currently repairable,” said Greg Smith, director of engineering, manufacturing, and repair at Airborne.

The process involves using a supersonic jet of expanded gas to spray metal powder onto a solid surface with sufficient energy to cause bonding. The material builds up and repairs the metal part or surface without creating a heat-affected zone. A video demonstration can be viewed at youtube.com/watch?v=mXZdPqH3Y_s.

The approval comes after three years of public-private collaboration funded by the State of Ohio to drive economic growth through advanced manufacturing. The University of Akron’s National Center for Education and Research on Corrosion and Materials Performance led the project with Airborne, SAFE Engineering Inc., and U.S. Technology Corp.

DAES Group to Distribute New Products

DAES Group, Arlington, Tex., a worldwide aerospace provider, and Flame Spray Technologies (FST), The Netherlands, a manufacturer of thermal spray solutions, have formed a partnership. DAES Group will be the distributor and service provider of FST thermal spray products and solutions for the aerospace market globally.

Juerg Bartlome, DAES Group CEO, mentioned accurate process control, system integration, and remote diagnosis are some of FST’s capabilities.

“I am confident that the DAES Group network will expand our presence in the aerospace industry and will widen our frontiers,” added Menno Zwetsloot, managing director.
Praxair Surface Technologies
Honored with Award

Praxair Surface Technologies (PST), Danbury, Conn., which offers coatings and technologies to the aviation, energy, and other industries, has received Pratt & Whitney’s 2018 Supplier Sustainability Award. This prize is given yearly to recognize a supplier that demonstrates exemplary commitment to environmental sustainability.

“PST is committed to improving our customers’ performance while helping them to reduce their environmental footprint,” said PST Vice President of Americas Dean Hackett.

Recently, the aviation industry has increased its focus on replacing chrome, cadmium, and other materials with more sustainable options. Praxair Surface Technologies offers replacement solutions that help reduce their reliance on these materials, helping to improve their environmental performance. Other advanced coating solutions also decrease energy consumption and reduce NOx emissions.

“We were particularly impressed with their transparency, ambitious targets, and alignment with Pratt & Whitney’s environment, health, and safety goals,” said Lisa Szewczul, vice president, environment, health, and safety, Pratt & Whitney.
Product Spotlight

Compact Thermal Spray Coating Machine Incorporates Three Spray Processes

Surface One™ integrates three spray processes, spray gun, part handling systems, and powder feed technology into one compact machine. The company’s first thermal spray coating machine packs into a standard shipping container and requires less floor space. The standard size makes it easy to relocate it to other areas of the production floor or another facility with minimal disruption to your operations. Overhead doors make loading parts easier and faster. Optimized airflow limits operator exposure to the thermal spray environment and reduces system cleaning. The coating module houses the thermal spray system that includes feeders, guns, and handling equipment, while the process module contains all auxiliary systems in a standardized format. Efficient access to all operating components allows you to do more. Additionally, the machine contains safe access to the auxiliary systems and allows up to four different materials to be fed individually or simultaneously. An intuitive, customizable Clarity™ user interface with integrated operator guidance eliminates operating errors, increases operational efficiency, reduces training requirements, and is ready for Industry 4.0 and the Internet of Things.

Oerlikon Metco
oerlikon.com/metco / + 41 58 360 96 96

Volumetric Powder Feeder Allows Instant Changeover of Powders

The PF-3350-MFS volumetric powder feeder allows instant changeover of different powders during the same coating/cladding process without emptying the powder canister. Available in 3350 cm³ volumetric capacity, the volumetric feeding principle exhibits excellent powder feed rate consistency throughout any thermal spray operation, thus contributing a significantly uniformed, thermally sprayed coating. With unlatching/latching toggle clamps, the complete canister assembly can be removed from the feeder base, thus allowing easy replacement with other prefilled canisters of different powders. In the single feeder type design, a stand is given on the portable trolley for the operator’s ease to place the detached feeder to keep the canister assembly safe and secure for the next operation, saving the operator’s time in changing the type of powder. It also avoids contamination of powder, which may happen due to changing of different powders in one canister. The powder feeders are available in a standard version with mass flow controlled independently and PLC-operated for standalone/multicoat processes. The powder feeders can be used with the company’s thermal spray systems or existing spray/cladding system.

Metallizing Equipment Co. Pvt. Ltd.
mecpl.com / +91 98296 50571

Industrial Dust Collector Provides New Features for a Safer Work Environment

The Gold Series X-Flo (GSX) industrial dust collector is ideal for industrial applications that produce or process fine, fibrous, and heavy dusts and fumes. The dust collectors are designed in modules to make it easy to build and assemble. Each module handles airflows up to 6000 ft³/min using four Gold Cone™ X-Flo filter cartridges. New filter cartridges are designed with more pleated media and surface area, so they can move more air and process more dust without increasing the collector’s overall footprint. The collector also features a newly engineered inlet and baffle configuration that creates a more uniform airflow, which extends the life of the filters. When the filters are pulse cleaned, more dust is channeled directly into the hopper instead of into the adjacent filters. The GSX dust collectors meet OSHA, NFPA, and ATEX Standards. They are available with protection options, including explosion vents, isolation valves, integrated safety monitoring filters, and fire-retardant filter cartridges.

Camfil APC
camfilapc.com / (800) 479-6801

Engineered Powders Designed for Both Advanced and Additive Manufacturing Processes

The company’s engineered powders combine both advanced and additive manufacturing (AM) processes, such as liquid thermal spraying. These composite powders represent metallic, ceramic, and polymer compositions, and are produced via atomization, sintering, fusion, and solid-state alloying processes. The available AM powders exhibit particle diameters with micro- to nanophase dimensions representing nanowire, nanotube, and nanoplatelet morphologies. The chemistries include both binary MX phases such as silicon carbide, and ternary MAX phases such as titanium silicon carbide. Special oxide dispersion-strengthened alloys, metallic high entropy compositions, containing a minimum of five metallic elements with similar covalent atomic radii, are produced via proprietary solid-state alloying processes. Commercial quantities of silicon, aluminum, titanium, tantalum, molybdenum, tungsten metal, and their metal alloys are supplied as spherical powders. Nonmetallic compounds are synthesized for oxides, suboxides, carbide, nitride, silicide, and boride formulations. The plastic powders are cryo-milled from pellets composed of polyethylene, aromatic polyester, polyimide, and more. Multiple component products containing metallic, ceramic, and polymer chemistries are produced via a mechanical fusion process using a thermoset resin or a hydraulic binder.

F.J. Brodmann & Co. LLC
fjbco.com / (504) 460-4365
Midis Energy Services Ltd. specializes in thermal spraying and applying surface treatments to metal components in Nigeria. By continuously developing new surface coating processes, the company meets the industry's various needs for new assets and products, and gives engineers ways to repair and protect a wide range of mechanical engineering assets, facilities, and equipments. The company utilizes HVOF, flame spraying, arc spraying, and plasma spraying. Its primary objective is to offer quality, cost-effective, innovative, and cutting-edge solutions designed to meet the present-day challenges of the oil and gas industry.

Nigeria
+234 802 582 7570 / midisenergyservices.com

Rockwell Carbide Powders Ltd. has been supplying hardfacing materials for the North America market for decades. The company sticks to precise and demanding standards during its production process, and every single production step is strictly controlled. Rockwell supplies high-quality materials to its customers, with various categories of product, including thermal spray powder, plasma transferred arc welding powder, laser cladding powder, and tungsten carbide wear parts. Its task is to recommend, design, develop, and produce the products to satisfy strict requirements. The company's high-tech materials prolong equipment service life considerably.

Unit 4, 70 Gibson Dr.
Markham, ON, Canada
L3R 4C2
905.470.8885 / rockwellpowders.ca
Happy New Year! I hope 2018 was successful and wish you all the best in 2019.

Looking back briefly at 2018, we lost a pioneer in the thermal spray industry — James “Jim” Browning, who has been recognized as the father of the continuous HVOF process. He passed away at 96. Those who knew Jim well were aware he seemed to think/dream up modifications and uses for existing and new thermal spray devices. He typically documented his ideas on yellow legal pads. They were hand-drawn, highly detailed, and memorable sketches. He also contributed to the development of plasma arc cutting, plasma arc welding, and plasma spray, which have also impacted our industry. We will miss this true entrepreneur, scientist, educator, and inventor.

Looking forward to 2019, ITSA will be organizing a fall membership meeting combined with a symposium on aerospace thermal spray applications. Your input is welcome, as the organizing committee will soon be reaching out to members and those in the aerospace industry to develop the program on the latest applications, materials, and processes serving the aerospace market.

**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**

**Chairman:** David Lee, Kennametal Stellite Company  
**Vice-Chairman:** Ana Duminie, North American Höganäs

**EXECUTIVE COMMITTEE** (above officers plus the following)  
Jim Ryan, TechMet Alloys  
Dan Hayden, Hayden Corporation  
Bill Mosier, Polymet Corporation  
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](http://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.

**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.

Share your company news, facility improvements, acquisitions, and noteworthy events with us.

Email press releases to spraytime@thermalspray.org.

Recognize Quality...

...Quality Products
...Quality Service
...Quality in Thermal Spray

See all of our products at www.thermach.com

ph: (920) 779 - 4299
fax: (920) 779 - 4452
salesatThermach@gmail.com

Manufacturer of
High Performance Wire for Hardfacing,
Welding and Thermal Spraying.

Polymet
polymet.us
sales@polymet.us
+1.513.874.3586

Wire for the World
Whatever your needs, wherever you are
We’ll get you wired.
People in the News

Höganäs Replaces Board of Directors Chair

Kurt Jofs has assumed the position of chairman of the Höganäs Board. He has been a member of the board of directors since 2013 and brings a long and broad experience from leading positions within Swedish industrial companies such as Ericsson and ABB. Jofs succeeds Staffan Bohman, who held the chairman position since 2013 when Lindengruppen and FAM bought and delisted Höganäs from the stock exchange.

James A. Browning

James A. Browning passed away on October 8, 2018. He was 96 years old. Browning was born in Great Neck, N.Y., and attended Blair Academy and Dartmouth College. After earning a master’s degree in engineering from Stanford University, he accepted a teaching job at Dartmouth College and moved to Hanover, N.H., in 1949, where he taught until 1966. An engineer in the mold of the “eccentric inventor,” Browning made thousands of design sketches on yellow lined paper, some of which would become testable prototypes. He received dozens of patents for his unique designs and continued to design and patent inventions throughout his life. He had a passion for developing high-temperature, high-velocity flame equipment used for metallizing, cutting, and channeling granite. Browning also founded Thermal Dynamics Corp. in Lebanon, N.H., in 1958. He left the company in 1968 to concentrate on high-velocity oxyfuel flame spraying equipment and continued to sell a flame channeler used to quarry granite. He later started Browning Engineering in Cannan, N.H. Browning is survived by his wife Lucille; children William, Joel, and James; and two grandchildren.

Maurice “Mo” Eugene VandenBergh

Maurice “Mo” Eugene VandenBergh, 68, passed away on December 24, 2018. He was in sales for Praxair/Miller for 19 years before founding VandenBergh & Associates in 2003. The company serves as a ceramic engineering consulting and repair company. VandenBergh was involved with many organizations and was a member of the American Ceramic Society and the Knights of Columbus. He also served on the board of the Thermal Spray Society. He is survived by his wife Elaine; children Maurice, Jackie, and Katie; and siblings Donald and Doris. ▲

WHERE IS YOUR ADVERTISEMENT?

From classified to business card to full-page sizes, we can work with your format.

Please visit spraytime.org for rate information,

or email the SPRAYTIME® publishing office via kim.daniele@mci-group.com.
“Quality you can see, Service you can Trust”

Precision Spray and Coatings has been in Houston, TX for over 9 years providing their Customers with Hard Chrome Plating and HVOF Coatings for downhole tool components. We also provide shot peening, glass beading, phosphate, precision grinding, vertical honing, polishing, as well as working with companies developing new coatings for R&D projects. We currently have a 70,000 sq. ft. facility close to George Bush Intercontinental Airport.

Precision Spray and Coatings conducts its business in a manner that supports the protection and preservation of our environment. We adhere to all local, state, and federal EPA standards. We have a state-of-the-art air pollution controls and chrome reclamations system.

If you need assistance or would like to set up a time for a personal tour of our facility, please call the office at (281) 449-0555.

16104 E. Hardy Rd Houston, TX 77032
www.precisionsprayandcoatings.com

Call the ‘Powder Doctor’
For all your coating and parts forming material needs from the largest selection of Engineered Powders & Advanced Materials

- FJB Engineered Powders
- FloMaster™ Powders
- CotMaster™ Powders
- SpaceMaster™ Powders
- LubMaster™ Powders
- BlasMaster™ Powders
- Thermal / Cold Spray Powders
- Plastic Coating Powders
- Functional Filler Powders
- Shut Peening & Blast Media

- 24 hrs. Technical Service
- Same day shipment with overnight delivery to most U.S. destinations.
- Powder and wire consumables for HVOF • Arc Spray • Plasma
- Complete, custom thermal spray cells

F.J. Bredmane & Co., LLC.
Oaktmere Research Park
2072 Sussex St.
Harvey, LA 70058
Cell: 504-460-4365
Tel/Fax: 504-540-9579
Email: info@fjbc.com

Your One-Stop Shop for Thermal Spray Equipment and Consumables

- TAFÁ® thermal spray coating equipment
- Genie- and TAFÁ®-brand spare parts
- Powder and wire consumables for HVOF • Arc Spray • Plasma
- Complete, custom thermal spray cells

Turn to Praxair Surface Technologies for thermal spray solutions with versatile applications and precise results, backed by 50 years of coating R&D.

bit.ly/PSTTSEC | 603.224.9585 | psti-info@praxair.com

© Copyright 2018 Praxair Surface Technologies, Inc.
ITSA Membership

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.

JOB SHOP MEMBER COMPANIES

ACCUWRIGHT INDUSTRIES INC.
Gilbert, AZ
Mr. David Wright | dave@accuwright.com
480.892.9595 | accuwright.com

ATLAS MACHINE & SUPPLY INC.
Louisville, KY
Mr. Richie Gimmel | richie@atlasmachine.com
502.584.7262 | atlasmachine.com

BENDER CCP INC.
Vernon, CA
Mr. Doug Martin | dmartin@benderus.com
323.232.2371 | benderus.com

BYRON PRODUCTS
Fairfield, OH
Mr. Keith King | kking@byronproducts.com
513.870.9111 | byronproducts.com

CASTOLIN EUTECTIC
Lausanne, Switzerland
Ms. Patricia Frund | marketing@castolin.com
0041.21.694.1132 | castolin.com

CINCINNATI THERMAL SPRAY INC.
Cincinnati, OH
Mr. Kirk Fick | kfick@cts-inc.net
513.699.3992 | cts-inc.net

CURTISS-WRIGHT SURFACE TECHNOLOGIES
Windsor, CT
Mr. Peter Ruggiero | peter.ruggiero@cwst.com
860.623.9901 | cwst.com

ELLISON SURFACE TECHNOLOGIES INC.
Mason, OH
Mr. John Langello | jlangello@ellisonsurfaceotech.com
513.770.4928 | ellisonsurfaceotech.com

EXLINE INC.
Salina, KS
Mr. Brent Hilbig | b.hilbig@exline-inc.com
785.825.4683 | exline-inc.com

F.W. GARTNER THERMAL SPRAYING
Houston, TX
Mr. Richard McCullough | rmcullough@fwgts.com
713.225.0010 | fwgts.com

FUSION INC.
Houston, TX
Mr. Jeff Fenner | jfenner@fusionhouston.com
713.691.6547 | fusionhouston.com

HAYDEN CORP.
West Springfield, MA
Mr. Dan Hayden | daniel.hayden@haydencorp.com
413.734.4961 | haydencorp.com

HFW INDUSTRIES INC.
Buffalo, NY
Mr. Matt Watson | mwatson@hfwindustries.com
716.875.3530 | hfwindustries.com

KERMETICO INC.
Benicia, CA
Mr. Andrew Verstak | averstak@kermetico.com
707.745.3862 | kermetico.com

METCUT RESEARCH INC.
Cincinnati, OH
Mr. Triratna Shrestha | tshrestha@metcut.com
513.271.5100 | metcut.com

MIDIS ENERGY SERVICES LTD.
Lagos, Nigeria
Mr. Atamuno Atamuno | atamunomidisenergy@midisenergy.com
midisenergy@midisenergy.com

NATION COATING SYSTEMS
Franklin, OH
Mr. Pat Pelzer | patp@nationcoating.com
937.746.7632 | nationcoating.com

PRAXAIR SURFACE TECHNOLOGIES
Indianapolis, IN
Mr. Michael Brennan | michael_brennan@praxair.com
317.240.2500 | praxair.com

SPRAYMETAL INC.
Houston, TX
713.924.4200
spraymetal.com

SUPERIOR SHOT PEENING INC.
Houston, TX
Ms. Mollie Blasingame | mmbsuperiorshotpeening.com
281.449.6559 | superiorshotpeening.com

SUPPLIER MEMBER COMPANIES

AAF INTERNATIONAL
Louisville, KY
Mr. David Kolstad | dkolstad@aafintl.com
800.477.1214 | aafintl.com

ALLOY COATING SUPPLY
Spring, TX
Mr. Jeffrey Noto | jnoto@alloycoatingsupply.com
281.528.0980 | alloycoatingsupply.com

AMETEK INC.
Eighty-Four, PA
Ms. Cindy Freeby | cindy.freeby@ametek.com
724.225.8400 | ametekmetals.com

ARC SPECIALTIES
Houston, TX
Mr. Daniel Allford | dan@arcspecialties.com
713.631.7575 | arcspecialties.com

ARDLEIGH MINERALS
Beachwood, OH
Mr. Ernie Petrey | epetrey@ardleigh.net
216.464.2300 | ardleigh.net

CAMFIL APC
Jonesboro, AR
Mr. Matt Caulfield | matt.caulfield@camfil.com
800.479.6801 | farrapc.com

CARPENTER POWDER PRODUCTS
Pittsburgh, PA
Mr. Jason Simmons | jsimmons@cartech.com
412.257.5102 | carpenterpowder.com

SURFACE ENGINEERING AND ALLOY CO.
St. Petersburg, FL
Mr. Scott Miller | scotm@surfaceengineering.com
727.528.7998 | surfaceengineering.com

SURFACE MODIFICATION SYSTEMS INC.
Santa Fe Springs, CA
Ms. Adriana Udave | adriana@surfacedevelopment.com
562.946.7472 | surfacedevelopment.com

TOCALO CO. LTD.
Japan
Mr. Daisuke Inoue | inouedaisuke@tocalo.co.jp
817815207646 | tocalo.co.jp/english

TUNGCO POWDER PROCUREMENT
Madisonville, KY
Mr. Ryan Szemore | rszemore@tungco.com
270.825.0000 | tungco.com

WHITE ENGINEERING SURFACE CORP.
Newtown, PA
Ms. Colby Nyland-Elliott | cnylande@whiteengineering.com
215.968.5021 | whiteengineering.com
ASSOCIATE MEMBER ORGANIZATIONS

ADVANCED MATERIALS AND TECHNOLOGY SERVICES INC.
Simi Valley, CA
Dr. Robert Gansert | rgansert@adv-mts.com
805.433.5251 | adv-mts.com

MASON GLOBAL MANAGEMENT LLC
Killingworth, CT
Mr. Richard F. Mason
rmason@masonglobalmanagementllc.com
724.554.9439 | masonglobalmanagementllc.com

STATE UNIVERSITY OF NEW YORK AT STONY BROOK
Stony Brook, NY
Prof. Sanjay Sampath | ssampath@ms.cc.sunysb.edu
631.632.8480 | ctsr-sunysb.org

STRENGTH COATING SYSTEMS
Franklin, OH
Mr. Larry Grimenstein | strengthdone@cs.com
937.704.4020 | strengthdone.com

SUPPORTING MEMBER SOCIETIES

DVS, THE GERMAN WELDING SOCIETY
Mr. Jens Jerzembeck
jens.jerzembeck@dvs-hg.de
die-verbindungs-spezialisten.de

GTS E.V., THE ASSOCIATION OF THERMAL SPRAYERS
Mr. Werner Kroemmer
werner.kroemmer@gts-ev.de
+49.89.31001.5203 | gts-ev.de

IMM, INSTITUTE OF MATERIALS MALAYSIA
Mr. Johar Juhari | johar_juhari@petronas.com.my
603.5882.3584 | iomm.org.my

JTSS, JAPAN THERMAL SPRAY SOCIETY
Mr. Nick Yumiba
jtss@mb8.selkyou.ne.jp
+81.6.6722.0096 | jtss.or.jp

MPIF, METAL POWDER INDUSTRIES FEDERATION
Mr. James R. Dale | jdale@mpif.org
609.452.7700 | mpif.org

TSCC – THERMAL SPRAYING COMMITTEE OF CHINA SURFACE ENGINEERING ASSOCIATION
Prof. Huang Xiao | xiaous@chinathermalspray.org
+86.10.64882554 | chinathermalspray.org
**MARCH 2019**

- **European Coatings Show 2019**
  March 18, 19 / Nuremberg, Germany
european-coatings-show.com

- **Advanced Manufacturing and Repair of Gas Turbines**
  March 19, 20 / Berlin, Germany
  event.asme.org/amrgt

- **Corrosion 2019**
  March 24–28 / Nashville, TN
  nacecorrosion.org

**APRIL 2019**

- **2019 62nd Annual Society of Vacuum Coaters Technical Conference**
  April 27–May 2 / Long Beach, CA
  svc.org

**MAY 2019**

- **Offshore Technology Conference (OTC)**
  May 6–9 / Houston, TX
  2019.otcnet.org

**JUNE 2019**

- **Turbo Expo**
  June 17–21 / Phoenix, AZ
  event.asme.org/turbo-expo

- **Additive Manufacturing with Powder Metallurgy**
  June 23–26 / Phoenix, AZ
  mpif.org

**SEPTEMBER 2019**

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

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

**OCTOBER 2019**

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

**NOVEMBER 2019**

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

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

---

**IS YOUR EVENT LISTED?**

Send calendar notices to **SPRAYTIME®**
at spraytime@thermalspray.org
2019 – 2020
AWS CONFERENCES

- Plastics Conference
  Apr 30, 2019

- RWMA 2019 Resistance Welding School
  May 15, 2019 – May 16, 2019

- 2019 Welding Industry Summit
  Aug 29, 2019 – Aug 30, 2019

- Shipbuilding / Aluminum Conference
  Sep 17, 2019 – Sep 19, 2019

- 2019 Aerospace Joining Conference
  Sep 23, 2019 – Sep 26, 2019

- 2020 Inspection Conference
  Jan 21, 2020 – Jan 23, 2020

- International Brazing and Soldering Conference
  Mar 15, 2020 – Mar 18, 2020

Please visit aws.org/events/Conferences for more details and registration information.

Advertiser Index

Your SPRAYTIME publication is provided to you at no charge by our advertisers. We encourage you to thank these advertisers by visiting, contacting, and referring their products and services at every opportunity.

Alloy Coating ..........................................................................................................................................................................................15

FJ Brodmann ..........................................................................................................................................................................................19

Metallizing Equipment Co. Pvt Ltd ....................................................................................................................................................Inside Front Cover

Polymet Corp ......................................................................................................................................................................................17

Praxair Surface Technologies ............................................................................................................................................................19

Precision Spray & Coatings ...............................................................................................................................................................19

Thermach Inc ......................................................................................................................................................................................17
We’ve Come a Long Way…

For more than 70 years our history has been synonymous with thermal spray innovation, education, and standards development. As we celebrate this milestone and the progress we’ve made over the years, we invite you to learn more about us and our impact on the thermal spray industry.

Read our history at go.aws.org/AboutITSA
or find out more about us at go.aws.org/itsavid