

SPRAYTIME®

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Volume 16, Number 3 Third Quarter 2009

New Developments

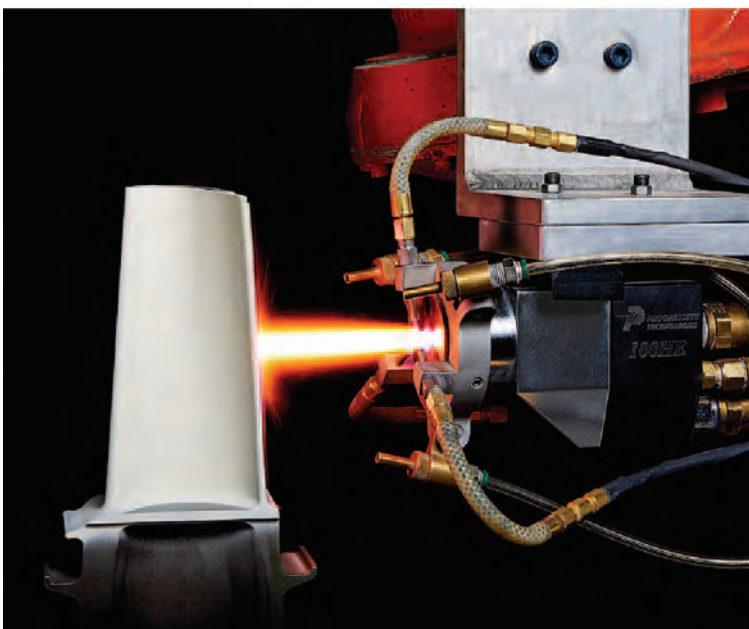
IGT and Aircraft Engine Coatings

The aircraft and Industrial Gas Turbine (IGT) industries constantly face new challenges as their hot sections are required to operate at higher temperatures and faster speeds for improved efficiency. To achieve this enhanced performance, the industry relies more and more on protective and clearance control coatings.

Whether the issues are high temperature (ceramics), wear (superalloys or carbides), component clearance control (abradables), or corrosion resistance, the manufacturers of these engines are solving many of their problems by utilizing thermal sprayed coatings engineered to meet these performance challenges.

Thermal spray devices have been used to apply Thermal Barrier Coatings (TBCs) for decades. During the early development of TBC coatings a ceramic rod gun was used to spray TBCs onto the Apollo program heat shields to protect the space capsule and astronauts during reentry into earth atmosphere.

Originally TBC coatings were sprayed with powder combustion torches or combustion rod guns, but due to the lack of control and efficiency they gave way to air or atmospheric plasma spray (APS) devices.



Consisting of an ionized gas, plasma is often referred to as the forth state of matter (solid, liquid, gas, and plasma). The best known naturally formed plasma is our own sun. As in the case of our sun, the extremely high temperature that is associated with APS makes the plasma stream capable of melting any known substance. This makes APS devices the most versatile of all thermal spray processes with the ability to spray any material available in a powder form that does not sublime (go directly from a solid to a gas; not having a liquid phase).

Most TBC coatings are now sprayed with air plasma, but some thin, dense coatings are deposited by electron beam physical vapor deposition (EB-PVD) processes.

continued on page 4

For more information and to register for the "New Developments in Thermal Spray Coatings, Processes and Applications" Conference, see page 2 and visit www.fabtechexpo.com

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NEW Thermal Spray Conference

New Developments in Thermal Spray Coatings, Processes and Applications Conference

November 16, 2009, Chicago, IL USA

The American Welding Society and The International Thermal Spray Association are organizing the first Thermal Spray and Coatings Conference at FABTECH 2009. This one-day event will be held in conjunction with the FABTECH International and AWS Welding Show including METALFORM.

Visit www.fabtechexpo.com to register.

The conference sessions are listed as follows:

An Overview of Thermal Spray Processes and Applications

Richard Thorpe, Praxair Surface Technologies

Practical Understanding of Materials for Thermal Spray Applications

Mitch Dorfman, M. Oechsle and C. Dambra, Sulzer Metco (US)

Comparison of Hardcoating Processes

Daniel Hayden, Hayden Corp.

Wire Arc Sprayed Anti-Corrosion and Wear-Resistant Coatings for Waste Incineration Plants

J. Wilden, Berlin Institute of Technology

Tungsten-Based Coatings to Enhance the Performance of Casting Molds

J. Wilden, S.Jahn, V.E. Drescher, Berlin Institute of Technology, Germany

A Review on Cold Gas Dynamic Sprayed Coatings

Tarun Goyal, SVIET, RamNagar (Banur), Punjab; Dr.T.S.Sidhu, SBSCET, Ferozpur, Punjab, Dr.R.S.Walia, PEC (Deemed University), Chandigarh

Practical Applications of Cold Gas-Dynamic Spray

David W Wright, Accuwright Industries, Inc.

Shockwave Induced Cold Spraying: Evaluation of a New Solid-State Spraying Process

Julio Villafuerte, Centerline Windsor Ltd

Carbide Based Thermal Spray Powders with Alternative Matrix Alloys - The only Choice to Protect your Health and Environment

Stefan Zimmermann, Benno Gries, Jürgen Fischer, H.C. Starck GmbH

Optimization of Cold Sprayed Titanium Coatings on Adhesion Strength

W. Wong and S. Yue, McGill University; E. Irissou and J.-G. Legoux, National Research Council Canada

Advanced Deposition Characteristics of Atmospheric Plasma Sprayed Bronze/Diamond Composite by Thermal Barrier Effect of Nickel Protective Thin Film

Hyunteak Na, Sanghoon Yoon, Kicheol Kang, and Changhee Lee, Hanyang University; Hyungjun Kim, Research Institute of Industrial Science & Technology

Dense Ceramic Coatings Produced by Slurry Axial Plasma Spraying

Michael Molnar, Mettech

Cermet and Ceramic Coatings with Novel Thermal Spraying Methods

Junya Kitamura, Kazuto Sato, Nobuaki Kato and Hiroaki Mizuno, Fujimi Inc.

Advanced Vacuum Plasma Spray (VPS) for Rapid and Safe Closeout of Cooling Channels for Liquid Rocket Engine Combustion Chambers

Chris Power, Genie Products Inc

Shockwave Induced Spraying: A New Cost-Effective Solid-State Spraying Process

Éric Irissou, Jean-Gabriel Legoux and Christian Moreau, National Research Council

Methods and Effects of Cooling Work Parts During WC-CoCr HVOF Coating

L.A. Mercado and Z. Zurecki, Air Products

Gun Mounts for the Articulated Robot; Fibonacci Comes Through Again

Dale Moody, Plasma Powders and Systems

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SPRAYTIME Third Quarter 2009

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Published by
International Thermal Spray Association

Mission: To be the flagship thermal spray industry newsletter providing company, event, people, product, research, and membership news of interest to industrial leaders, engineers, researchers, scholars, policy-makers, and the public thermal spray community.

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Dan Hayden Editor

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continued from page 1

Throughout the evolution of IGT and aircraft engines, air plasma spray has become the most prominent process for the application of TBC coatings. Initially low energy, low enthalpy torches applied these coatings at low spray rates and relatively low deposition efficiencies. In the last decade or so, some plasma torches have evolved with significantly higher power levels and higher enthalpies, enabling extremely high spray rates and deposition efficiencies.

Since the advent of the plasma spray torch and its prominent use in spraying these TBC coatings, a significant amount of coating development has taken place. To achieve specific coating properties, many different powder particle size ranges and manufacturing morphologies have been explored.

Many coating properties designed into IGT engines specify TBC coatings that contain vertical cracks in both dense and porous coatings. On some larger parts, IGT manufacturers may specify coatings containing anywhere from 25% porosity down to very dense coatings.

The aircraft engine manufacturers have not yet embraced the APS vertically cracked coatings, but there is research being conducted to identify the feasibility for use in some applications. Currently aircraft engine manufacturers specify varying degrees of porosity for their OEM coating activities, overhaul shops and for their approved coating vendors.

To illustrate some of the differences in coating properties, the coating microstructures shown in Figures 1 through 5 were sprayed with a patented single anode, single cathode high energy plasma spray torch using a ternary gas mixture of argon, nitrogen and hydrogen. Torch power levels of 95 KW to 100 KW were used to produce the coatings. The examples show a variety of spray rates from 80 to 300 g/min with porosity levels from <1% to 15%, including some dense coatings with vertical cracks. The powders used were in particle size ranges of 15–45 microns, 22–44 microns and 20–106 microns. Depending on the required

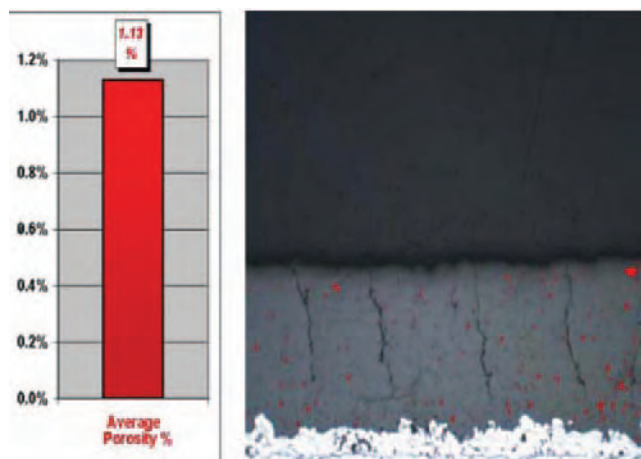


Figure 1. (50x) YZRO 93/7, 15-45 microns; hollow, spheroidal densified; 80% DE, 80 g/min, 104 vertical cracks/in.

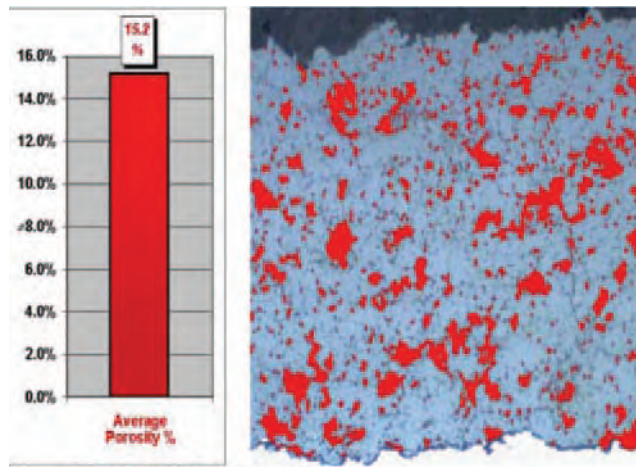


Figure 2. (100x) YZRO 93/7, 20-106 microns, agglomerated sintered, 60% DE, 300 g/min.

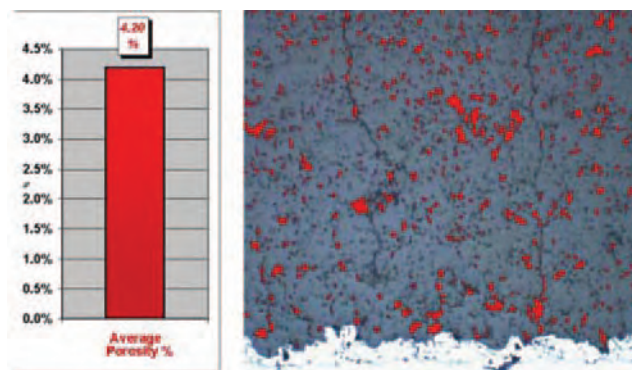


Figure 3. (50x) YZRO 93/7, 20-106 microns, agglomerated and sintered, 70% DE, 200 g/min, vertical cracks.

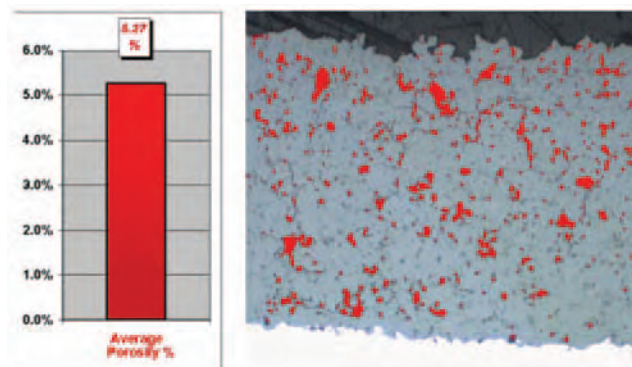


Figure 4. (100x) YZRO 93/7, 20-106 microns, agglomerated and sintered, 74% DE, 220 g/min.

coating properties, the morphology of the powder ranged from hollow spheroidal densified, to agglomerated sintered, to fused and crushed. To achieve the desired coating properties, parameters were developed that gave deposition efficiencies in the range of 60–80% dictated by particle size, spray rates and powder morphology. The bond coat for each sample is an MCrAlY material sprayed with the same torch hardware as used for the top coat.

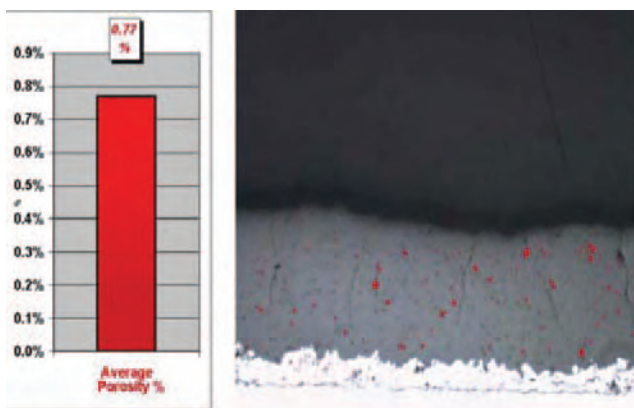


Figure 5. (50x) YZRO 93/7, 22–45 microns, fused, 76% DE, 80 g/min, 85 vertical cracks/in.

Parts That Are Plasma Sprayed With TBC Coatings

IGT Engines: transfer cases, 1st and 2nd stage turbine buckets (blades), compressor cases, combustion liners, shrouds (shroud blocks), 1st and 2nd stage nozzles, transition pieces, etc.

Aircraft Engines: blades and vanes, combustion liners, burner cans, nozzles, seals, compressor cases, etc.

For more information, contact author Larry Pollard, Application Manager, Progressive Technologies, Inc., Grand Rapids, Michigan USA, tel: 616.285.8350, email: lfp@ptihome.com, web: www.ptihome.com

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We will then send you an email message when the next *SPRAYTIME* issue is ready to be viewed online.

Join the ASM Thermal Spray Society Online Community Forum

ASM TSS members welcome visitors to register and access the new *searchable* forum, as well as explore the new online community.

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INDUSTRY NEWS

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St. Louis Metallizing Achieves Nadcap Certification

St. Louis Metallizing (SLM) reached a milestone by successfully passing the Nadcap certification process for "Coatings" which covers the following thermal spray processes: high velocity oxy fuel (HVOF), plasma thermal spray, combustion wire spray, combustion powder spray and electric arc wire spray. SLM was able to pass this initial audit with only five minor findings.



"Our success is due to dedicated personnel who understand the requirements of Nadcap and the

responsibilities that it brings" says John Passmore, Quality Manager, pictured with certification.

SLM has held Nadcap certification for fluorescent penetrant inspection for two years and achieved Merit Status by successfully passing the recent surveillance audit with

zero findings.

St. Louis Metallizing Company provides a full range of capabilities in thermal spray applications with special expertise in chrome replacement coatings and finishing capabilities for low to mid-range volumes of large or complex geometry parts with high quality and tight performance specifications.

For more information, visit www.stlmetallizing.com

Praxair Acquires Sermatech International

Praxair Surface Technologies, Inc., a subsidiary of Praxair, Inc. (NYSE:PX), has acquired Sermatech International Holdings Corp. from Arsenal Capital Partners, a New-York-based private equity firm. Sermatech is a global supplier of protective coatings and advanced processes used on industrial and aviation gas turbines. Sermatech serves the aerospace, defense, power generation and oil and gas markets. Financial terms of the transaction were not disclosed.

Sermatech's high-performance slurries, along with its diffusion and thermal spray coating processes, extend component life and reduce maintenance costs by limiting degradation of metal parts at high temperatures. Sermatech has operations in the U.S., Canada, United Kingdom, Germany and South Korea. The business generated sales of \$116 million in 2008 and has 625 employees.

"The addition of Sermatech coatings to our offerings, particularly its signature SermeTel® slurry-based product, further strengthens Praxair Surface Technologies' ability to serve customers in our target end markets," said Praxair Surface Technologies President Mark Gruninger. "Sermatech has built a reputation for quality surface treatments and an industry-leading brand worldwide. We welcome their employees to the Praxair team."

Gruninger said Sermatech and its employees will be integrated into Praxair Surface Technologies' global operations.

About Praxair Surface Technologies

Praxair Surface Technologies, with operations in 11 countries, had sales of \$575 million in 2008. The company offers a comprehensive slate of high-performance coatings and technologies to the aviation, industrial gas turbine, energy and other industries.

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NanoSteel® Wins Fourth R&D 100 Award for Hardmetal Alternative Wear Plate Technology

The NanoSteel® Company, a leader in nanostructured steel alloy surface technology solutions, announces that it has been awarded its fourth R&D 100 Award for the development of "Hardmetal Alternative Wear Plate Technology: NanoSteel Super Hard Steel® Wear Plate."

NanoSteel wear plate is an iron-based steel overlay solution for use in extreme high-wear industrial service environments as an alternative to composite carbide overlay and monolithic quench and temper (Q&T) wear plate. NanoSteel wear plate features a unique ultra-fine, sub-micron microstructure that is up to a thousand times smaller than competing overlay and Q&T plate products. This microstructure provides exceptional resistance to abrasive wear, fine particle erosion and impact, and can extend component service life by up to 3x longer than competing products.

"It's truly an honor for NanoSteel to have been selected as a 2009 award recipient by *R&D Magazine*," says Dave Paratore, president and CEO. "NanoSteel continues to experience notable success in obtaining wear resistance performance not thought to be achievable with iron-based steel alloy solutions. We believe we've achieved a new level of performance in material solutions that offer exceptional wear and impact resistance. These solutions have been shown to cost effectively extend service life for industries such as coal-fired power generation, mining and oil and gas."

NanoSteel wear plate was developed using the company's platform technology in iron-based nanomaterials. It is an extension of NanoSteel's thermal spray and weld overlay alloy solutions which have been recognized by three previous R&D 100 awards.

R&D 100 Awards are presented by *R&D Magazine* to industry, government and academia for recognizing the most innovative new products of the year.

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RJ Herbert Opts for Thermal Spraying with Metallisation at Potato Processing Plant

RJ Herbert Engineering has opted for thermal spraying, using Metallisation equipment, as an alternative to hot dip galvanizing, to improve customer service, reduce costs and save time.



The decision to opt for thermal spraying was made following a request from a Belgian customer, a potato processing and packaging line export company, to protect the walkways and handrails of the potato processor equipment. Herbert is a British manufacturer of handling equipment for the vegetable industry and environmental waste and recycling industries. Its client base includes European fresh produce pack houses, major international processors as well as many well-established growers and industrial companies.



With constant use of the walkways and handrails running alongside the process and packaging equipment, as well as cleaning and pressure washing, a sturdy surface protection is crucial to the longevity of the equipment. The customer specified a zinc coating should be applied prior to a powder coating finish using either hot dip galvanizing or thermal spraying. Herbert had extensive experience of galvanizing, but was unhappy with the downsides of this process, in this instance, and decided to explore thermal spraying options.

The reasons behind Herbert looking at thermal spraying, as an alternative to hot dip galvanizing, were based on the logistical cost and lead times associated with the off-site



process. Herbert needed to find an in-house alternative that had equal, or better, corrosion preventative properties. Having looked at all the processes available it was decided that not only did thermal spraying meet this criteria, but also meant that there was no post spraying operations such as re-drilling holes or cleaning of metal drips. The pre-spraying process was also simplified, as no special preparation, such as designing for heat distortion and holes for hot air expansion, was required. The main factors for the acquisition of the thermal spray equipment, were that the process is now done on site, no transport costs, no sub-contractor lead time, less product build time and no post spray operations are required.

Ken North, Operations Director at RJ Herbert Engineering, says: "Our decision to opt for thermal spraying, as an alternative to hot dip galvanizing, was made much easier once we made contact with Metallisation. We knew that thermal spraying could be an ideal alternative for us, but Metallisation's understanding of what we were trying to do was ideal. We are so pleased with the thermal spray equipment we have purchased from Metallisation. The outstanding results of the potato processing plant has encouraged us to offer the enhanced corrosion protection as an option to other customers across our full product range. So we are very happy all round."



In addition, Herbert use wet paint as well as powder coatings and hope to use the new thermal spray process for these applications too. It's hoping to reap the benefits of

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improved adhesion of paint to thermal spray without the need to etch primers, as they currently do when painting on to galvanized steel. The thickness of the thermal sprayed coatings will vary depending on the environment in which the sprayed item is located and on the customers' specific requirements.

The operator has found it easy to use and is happy to work with the system. Herbert also purchased a 66 ft (20 m) supplies package, which allows its operators to locate the spray unit outside the spray room and provides flexible access around the items they are spraying without having to stop to move equipment. Metallisation provided an on-site training course to maximise the efficiency of the equipment and ensure operators are totally familiar with the system. Herbert also opted for the Metallisation, Metserve preventative maintenance contract, which provides two visits per annum by a Metallisation service engineer to keep the system in excellent working order.

Herbert sprays zinc at this time but is currently considering spraying with aluminum for certain applications. Future considerations include offering a robust, nonslip thermal sprayed coating on walkways, stairs and inspection areas, to its clients.

Established in the UK in 1922, Metallisation is synonymous with thermal spraying to a diverse range of industries around the world. Thermal spraying is a technology, which protects and greatly extends the life of a wide variety of structures, equipment and vessels, in the most hostile environments and in situations where protective surface coatings are vital for longevity. The variety of thermal sprayed coatings is vast, but can be broken down into two main categories. These include anticorrosion and engineering coatings.

For more information on Metallisation, please call Stuart Milton, Sales and Marketing Manager, on 01384 252 464 or visit www.metallisation.com.

Swinburne Establishes Australia's First University-Based Thermal Spray Lab

The uses for thermal spray coatings, which, at their thinnest, are the width of a human hair, are rapidly on the rise—everything from artificial bone coatings for replacement joints to offshore oil platforms and, potentially, water purification and solar energy collection applications.

Thermal spray coatings end up in some unexpectedly intimate places. On artificial hip and knee joints they can help people play a determined game of tennis. On tooth implants they give us extra bite. And in the fiery world of jet propulsion, when applied to turbine blades, thermal spray coatings improve fuel efficiency and extend engine life.

Research by Professor Chris Berndt was pivotal in the development of these joint

and jet engine products, and remains a continuing interest of his. He is Professor of Surface Science and Interface Engineering at Swinburne University of Technology, where he is also director of the Industrial Research Institute Swinburne (IRIS).

Now, the science having been done, comes the task of equipping industry with people skilled in this constantly evolving technology. Professor Berndt's research team is moving to a new unit in Swinburne's TAFE division, signaling that the research will now also include training TAFE and higher education students in thermal spray technology to produce manufacturing engineers and technicians with coatings technology expertise.



Professor Chris Berndt's Swinburne research unit will now train students in thermal spray technology.

Photo: Paul Jones

The new facility will be the only university-based thermal spray lab in Australia. It will also simplify the steps needed by TAFE's industrial partners to bring thermal spray problems to Professor Berndt's group for solving.

For Australia's still-developing coatings industry it means direct access to emerging technology. Richard Moore, CEO of United Surface Technologies (www.ust.com.au), a Melbourne-based coatings company, says a lot of time is currently spent overseas keeping up with technical advances. "Having a world-class research and problem-solving group here in Melbourne is obviously a major advance for the industry," he says.

Mr Moore's company provides thermal spraying services for sectors including oil and gas, pulp and paper, cardboard products, printing, pumps and valves, mineral processing,



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automotive, medical, rail, and power generation. He says new coating technologies emerge each year, making it essential for the local industry to have access to developments, problem-solving expertise and trained graduates.

While many of today's thermal spray applications are at the cutting edge of new manufacturing and materials processes, the world's thermal spray research community actually celebrated the technology's 100th anniversary in 2006.

Thermal spray is a coating process in which melted (or heated) materials are sprayed on to a surface. The heated particles strike the surface to be coated, and repeated overlaying builds up a coating of millions of now-solidified particles. Unlike some coating methods, thermal spray does not require a vacuum, which makes it cheaper.

It is also faster than electroplating and vapor deposition. Many materials can be treated: metals, alloys, ceramics, plastics and composites. The typical coating thickness is 100 to 500 micrometers, the former being about the diameter of a human hair.

The main uses of thermal spray coatings are to control corrosion and provide protection from high temperatures.

For example, they are used routinely on car components and in the large control valves on offshore oil platforms. Even concrete bridge structures can be protected from corrosion with thermal spray coatings of zinc.

Professor Berndt's coatings for turbine blades allow them to run 180 F (100 C) hotter, lifting engine efficiency and saving fuel. "Even 0.5% improvement in efficiency can save billions of dollars for commercial and defense organizations," he says.

In his orthopaedic research, Professor Berndt developed an artificial bone coating for replacement joints and teeth. He says this bone-friendly ceramic material invites the creation of a "lovely sweet interface, as the natural bone knits with the coating, improving the body's grip on the prosthesis".

He expects thermal spray uses to increase. "I envision an abundance of real-world applications," he says. "These are likely to include water purification and solar energy collection. Solid oxide fuel cells are re-emerging, and long-life coatings will be essential in geothermal energy production."

"We can now design surface structures at the molecular scale for specific purposes. And we are experimenting with extremely thin surface spray coatings of only five micrometers. Our success will enable many new applications. For ultra-thin coatings, thermal spray could soon displace vapor deposition methods. I expect thermal spray to be a major solution for creating special surfaces, optimized for particular functions. The future is exciting."

For more information, contact Professor Chris Berndt at Swinburne University of Technology, email: CBerndt@groupwise.swin.edu.au

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For more information, contact Girish Mathur, Metallizing Equipment Co., India, email: mecpl@sancharnet.in, web: www.mecpl.com

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Flame Spray Technologies on the Move



Flame Spray Technologies (FST) is pleased to announce their move to new facilities in Grand Rapids, Michigan as of March 30, 2009. The new facilities feature expanded office and warehouse space to accommodate the new business model and growth experienced by FST.



"We have been fortunate to have been embraced by the thermal spray community over the past 10 years", says FST president Terry Wilmert. "We provide an excellent product backed by dedicated support and an approach to business

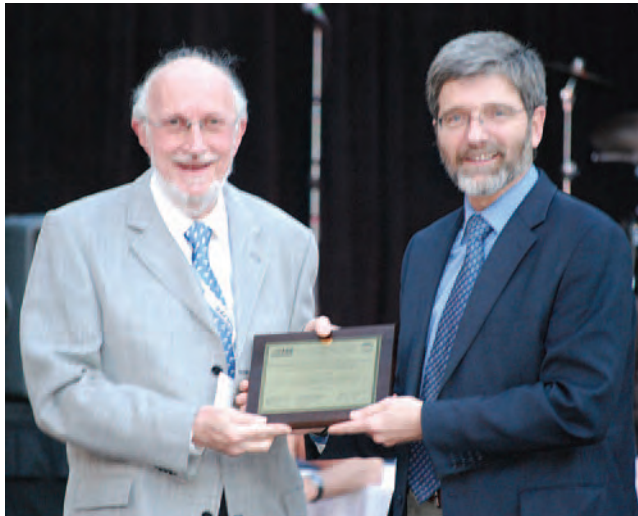
that we believe speaks of integrity.

We feel especially blessed to be able to undergo this expansion at a time when so many are having a different experience."

FST believes in long-term relationships and is therefore making a concerted effort to support their customers with on-demand deliveries. In order to do this, one of the things we have done is expand our warehouse space to be able to stock the necessary products. "We are even entering into special contractual arrangements with some of our customers to take this program to another level", says Wilmert. "There is a cost associated with this level of support, but our customers understand the return this service will provide them on their investment."

For more information, contact Terry Wilmert, Flame Spray Technologies United States 4881 Kendrick St. SE, Grand Rapids, MI 49512, email t.wilmert@fstincusa.com or visit website www.fst.nl

Journal of Thermal Spray Technology Volume 17 Best Paper Awards

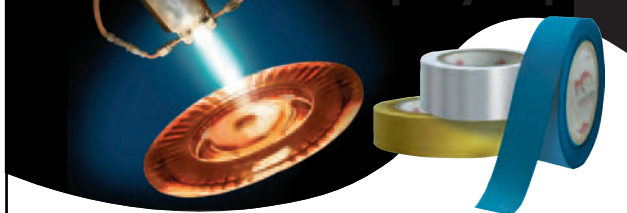


JTST Editor Christian Moreau presents the JTST Volume 17 Best Paper Award to Pierre Fauchais (left) for the paper "Parameters Controlling Liquid Plasma Spraying: Solutions, Sols, or Suspensions," which he coauthored with Ramuntxo Etchart-Salas, Vincent Rat, Jean-François Coudert, Nadège Caron, and Karine Wittmann-Ténèze.

The *Journal of Thermal Spray Technology* (JTST) is delighted to announce the winners of the JTST Volume 17 Best Paper Awards, as chosen by an international committee of expert judges. The awards were presented to the winning authors at the International Thermal Spray Conference and Exposition 2009, in Las Vegas, Nevada.

The *Journal of Thermal Spray Technology* publishes contributions on all aspects -- fundamental and practical -- of thermal spray science including processes, feedstock manufacture, testing, and characterization. As a leading forum on thermal spray technology, its mission is to synergize the rapidly advancing thermal spray industry and

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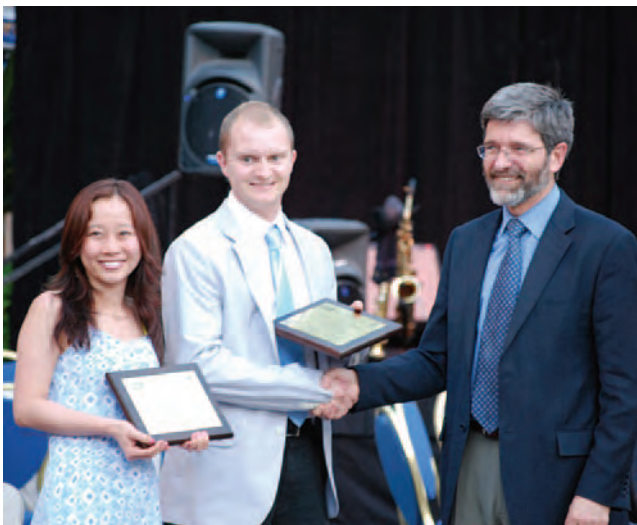
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related industries by presenting research and development efforts leading to advances in implementable engineering applications of the technology. The Journal presents critically reviewed scientific papers and engineering articles, combining the best of new research with the latest applications and problem solving.

The Editorial Committee and International Board of Review of the journal believe it is important to evaluate the quality of engineering and scientific contributions published in JTST and to provide recognition of excellent work and its publication. Each paper is reviewed and evaluated on its merits for scientific and engineering content, originality, and presentation style. The following papers are recognized as outstanding and the authors received awards of recognition for their excellent publications:

INDUSTRY NEWS



JTST Editor Christian Moreau presents the JTST Volume 17 Best Paper Award to (from left) Meng Qu and Andrew Gouldstone for their paper "On the Role of Bubbles in Metallic Splat Nanopores and Adhesion."

The Journal of Thermal Spray Technology Volume 17 Best Paper Award (two papers tied for first place):

"Parameters Controlling Liquid Plasma Spraying: Solutions, Sols, or Suspensions" by Pierre Fauchais, Ramuntxo Etchart-Salas, Vincent Rat, and Jean-François Coudert, University of Limoges; and Nadège Caron and Karine Wittmann-Ténèze, CEA le Ripault

"On the Role of Bubbles in Metallic Splat Nanopores and Adhesion" by Meng Qu, Massachusetts Institute of Technology, and Andrew Gouldstone, Northeastern University

The Journal of Thermal Spray Technology Volume 17 Best Paper Honorable Mention Award:

"Room Temperature Impact Consolidation (RTIC) of Fine Ceramic Powder by Aerosol Deposition Method and Applications to Microdevices" by Jun Akedo, National Institute of Advanced Industrial Science and Technology

Each of these three papers is an Editors' Choice article for 2008, and as such, is available as Open Access on SpringerLink.

The international committee of judges, led by Dr. Roland Seals, chair of the *Journal of Thermal Spray Technology* Best Paper Subcommittee, is as follows:

Arvind Agarwal, David V. Bucci, Nadège Caron, Andrew Gouldstone, Vincent Guipont, David Hart, Jan Ilavsky, Bertrand Jodoin, George Kim, Jiri Matejcek, André McDonald, Tim McKechnie, Petri Vuoristo, James A. Rudd, Philip Shipway, Tsunekawa Yoshiki, and Joel Voyer

Congratulations are extended to the winning authors from the JTST Editorial Committee and the ASM Thermal Spray Society Board of Directors.



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Written Programs An OSHA Inspector May Ask To See

Occupational Safety and Health Administration (OSHA) compliance involves maintaining several mandatory written programs and records. The following is a management checklist of 5 of the most common written programs and records that an OSHA inspector might ask to see.

1. OSHA 300 Log - If you have 10 or more employees, you need to keep an OSHA 300 Log (29CFR1904). The OSHA log is a uniform way of providing information to the Bureau of Labor Statistics (BLS). Make sure that whoever is in charge of keeping your OSHA 300 Log reads and understands the OSHA guidelines. In many cases, good case management and knowledge of the record-keeping rules can save you a recordable injury.
2. Lockout/Tagout Program - The purpose of a lockout/tagout program (CFR1910.147) is to ensure the safety of personnel by preventing equipment activation anytime maintenance or repair work is being performed. Programs must be designed to protect the safety of employees working on or close to equipment with the potential for unexpected operation, movement, release of energy, or release of hazardous materials.
3. Process Safety - OSHA's Process Safety Management Standard (CFR1910.119) establishes requirements that employers must follow to prevent catastrophic losses associated with certain chemical processes. Some of these requirements include employee training, prestart safety reviews, mechanical integrity inspections, and

emergency planning and response. The standard applies to any process involving one or more of the listed highly hazardous chemicals (such as ammonia, hydrochloric and hydrofluoric acids, hydrogen, and propylene) at or above the threshold quantity or any process that involves a flammable liquid or gas in a quantity of 10,000 pounds or more.

4. Emergency Action Plan - OSHA requires that action plans (CFR1910.38) be in writing and cover actions that designated employers and employees are expected to take to ensure employee safety from fire and other emergencies. The plans should identify potential emergency situations and convey to employees just what their responses should be.
5. Respirator Program - If respirators are necessary in your workplace to protect the health of employees, you must establish and implement a written respiratory protection program (CFR1910.134) with work site-specific procedures. The program must be updated as necessary to reflect changes in workplace conditions affecting respirator use.

Provided by the

ASM Thermal Spray Society Safety Committee

For more information, contact Chairman Greg Wuest via email: gregory.wuest@sulzer.com

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New Robot-Operated HVOF Chamber Applies Coatings To Parts Up To 20 Feet Long

Stork Cellramic is pleased to announce the completion of its new High Velocity Oxygen Fuel (HVOF) thermal spray chamber. The oversized workspace (15 x 28 ft) was designed to accommodate a robotically-operated thermal spray application and handling system for parts and products up to twenty feet in length and 15,000 lb. The chamber replaces two smaller spray booths in the Stork Cellramic facility in north Milwaukee.

Stork Cellramic experts apply HVOF thermally sprayed coatings to parts to help protect them against high temperature, wear and corrosion and for hard chrome replacement applications. Examples of parts that benefit from HVOF coatings include gas turbine hot-section components such as burner cans, baskets, nozzles, cross-flame tubes, spring clips, blades and vanes. Multi-axis robots, turntables and other

automated systems for coating application allow reproducibility and precise control of coating thickness and quality. Oversized parts, which require the dimensions of the new booth, are usually used by industries such as printing, paper, packaging, hydraulics and cylinder, die and shaft manufacturers.

General Manager Daniel Ruiter said, "Our team is very satisfied with the new installation and processes. The HVOF spray booth and its robot and turning cart is impressive to watch and will take care of our customers' most outsized parts and products. This is not our first robotic coating booth and not our only HVOF system, but it is our largest—and it is among the largest industrially available applicators in the Midwest.

"In addition to the new chamber, we have also made modifications to our grit blast enclosure in order to improve surface preparation, and we are in the final stages of achieving ISO certification, which should be granted to us in early October. We had a very successful audit with ISO and we look forward to providing this quality approval to our customers who require it."

continued on page 16



New HVOF chamber ready for operation for thermal spraying of oversized parts and products.



Stork Cellramic staff and contractors prepare the HVOF spray chamber and robotic arm for installation.









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continued from page 15

The HVOF chamber is fully operational and available to customers effective August 24. For more information, please contact cellramic@us.stork.com.

About Stork and Stork Cellramic

Stork Cellramic, Inc. (a member of the Stork Materials Group of companies) is a high-tech company specializing in the application and finishing of thermal sprayed coatings for industrial applications such as printing, converting, gas turbine, food processing and packaging. For more information, please visit the website at www.storkcellramic.com.

Stork Materials Technology is a network of independent, accredited laboratories providing testing solutions to industry throughout the US and Europe. Stork engineers, scientists, failure analysts, and product development and qualification experts support businesses with materials selection and engineering, materials testing, performance testing, failure analysis and consulting, nondestructive testing and inspection, calibration, construction materials testing and engineering, polymer and advanced materials testing, dimensional inspection, surface treatment, product qualification and development, and more.

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Journal of Thermal Spray Technology®

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Abstract: Modified Indentation Techniques to Prove Inelasticity in Ni-5%Al Coatings from Different Processes

W.B. Choi, Y. Wu, S. Sampath, and A. Gouldstone

In this study, two types of indentation experiments were performed on metallic (Ni-5%Al) coatings prepared by cold spray, high velocity oxy-fuel and air plasma spray. In the first type, spherical tips were used with increasing loads, and subsurface deformation was observed using a modified bonded interface technique. In the second type, cyclic loading was imposed with a sharp tip, and tip displacement was continuously recorded. Results suggest that cold spray coatings are brittle under contact loads in their as-sprayed condition, and that they exhibit a size effect that is quite different from those of the other coatings. That is to say, heterogeneities in mechanical behavior exist not as much on the single particle level as expected, but on a much larger scale of order 100 microns. This is attributed to long unbonded regions between particles, in a coating of otherwise high density. Fracture mechanics arguments support this hypothesis.

Read the entire article in the March 2009 *Journal of Thermal Spray Technology*.

For more information, visit www.asminternational.org/tss

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Colmonoy 88 for Waste-to-Energy Plants

Over three years ago, a large waste-to-energy plant performed the first large-scale test of a Colmonoy spray-and-fuse alloy. They had an experienced job shop overlay 86 boiler tubes using Colmonoy 88. The tubes were coated 25 ft length and 2.5 in. dia. Tube-metal temperatures approached 900 F, and the boiler ran 24/7. The tubes are vital components of a super-



Superheater tubes sprayed and furnace fused with Colmonoy 88.

heater in one of the boilers, and a way of protecting the tubes to extend their life from, at best, a one year cycle was needed.

Colmonoy 88 extends boiler tube life, especially in the secondary superheater section of a boiler where the most severe environment exists for mass burn and refuse derived fuel boilers. Boiler-tube life is one year or less in soot blower lanes, where

soot blower lances clean the front and back ends of superheaters.

Colmonoy 88 offers four distinct advantages for superheater tubes and panels:

- Longer life than tube shields, stainless tubes, or any type of Inconel overlay including Inconel® 625, 622, 52 and 72.
- Improved high temperature erosion properties compared with other alloys tested.
- Reduction of molten salt or slag build-up on the tubes.
- Better heat transfer properties than shielding or overlays.
- Reduced maintenance costs via labor and material savings.

Through extensive field tests in superheaters, Colmonoy 88 has proven superior to tube shielding, overlays, and stainless tubes.

The waste-to-energy plant is pleased with the test results and plans to test Colmonoy 88 in two other plants.

For further information about this application, please contact abreer@wallcolmonoy.com

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The Zanchuk Group, LLC - Concord, NH USA

www.zanchuk.com 603.226.3712

Mr. Val Zanchuk, zanchuk@comcast.net

SUPPORTING SOCIETIES

AWS, The American Welding Society

www.aws.org 305.443.9353

Mr. Jeff Weber, jweber@aws.org

GTS e.V., The Association of Thermal Sprayers

www.gts-ev.de +49.89.31001.5203

Mr. Werner Kroemmer, werner.kroemmer@gts-ev.de

JTSS, Japan Thermal Spray Society

+81.6.6722.0096

Mr. Nick Yumiba, jtss@mb8.seikyoku.ne.jp

MPIF, Metal Powder Industries Federation

www.mpif.org 609.452.7700

Mr. James R. Dale, jdale@mpif.org

International Thermal Spray Association

email: itsa@thermalspray.org web: www.thermalspray.org



Chairman Hayden

company representatives to better understand member benefits. A complete list of ITSA member companies and their representatives are at www.thermalspray.org

ITSA Mission Statement

The International Thermal Spray Association is a professional trade organization dedicated to expanding the use of thermal spray technologies for the benefit of industry and society.

Officers

Chairman: **Dan Hayden**, Hayden Corporation
 Vice-Chairman: **David Wright**, Accuwright Industries, Inc.
 Treasurer: **Bill Mosier**, Polymet Corporation
 Corporate Secretary: **Kathy Dusa**
Executive Committee (above officers plus)
Marc Froning, BASF Catalysts LLC
John Read, National Coating Technologies
Scott R. Goodspeed, Farr Air Pollution Control
Joseph Stricker, St. Louis Metallizing Company

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 www.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 which is now on display at their headquarters office in Fairport Harbor, Ohio USA.

Growing in size and value, there are now over 30 different spray guns and miscellaneous equipment, a variety of spray gun manuals, hundreds of photographs, and several 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 Newsletter

Since 1992, the International Thermal Spray Association has been publishing the **SPRAYTIME** newsletter for the thermal spray industry. The mission is to be the flagship thermal spray industry newsletter providing company, event, people, product, research, and membership news of interest to industrial leaders, engineers, researchers, scholars, policy-makers, and the public thermal spray community.

For a free **SPRAYTIME** subscription, visit www.spraytime.org and complete the short questionnaire.

ITSA Headquarters

208 Third Street, Fairport Harbor, Ohio 44077 USA

tel: 440.357.5400 fax: 440.357.5430

itsa@thermalspray.org www.thermalspray.org



Become a Member of The International Thermal Spray Association

Your company should join the International Thermal Spray Association now!

As a company-member, professional trade association, our mission is dedicated to expanding the use of thermal spray technologies for the benefit of industry and society.

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

Whether you are a job shop, a captive in-house facility, an equipment or materials supplier, an educational campus, or a surface engineering consultant, ITSA membership will be of value to your organization.

The most valuable member asset is our annual membership meetings where the networking is priceless! Our meetings provide a mutually rewarding experience for all attendees - both business and personal. Our one day Technical Program and half day business meeting balanced by social activities provide numerous opportunities to discuss the needs and practices of thermal spray equipment and processes with one another.

As an ITSA member, your company has excellent marketing exposure by being listed on our website along with a multitude of additional benefits.

ITSA member companies are also highlighted in the ITSA booth at several trade shows throughout the year (International Thermal Spray Conference ITSC, Fabtech International and AWS Welding Show Thermal Spray Pavilion, Weldmex Mexico, and TurboExpo in 2009).

If you would like to discuss the benefits of your company becoming a member of the International Thermal Spray Association, we suggest you contact Kathy Dusa at our headquarters office or visit the membership section of our www.thermalspray.org website.

International Thermal Spray Association Welcomes New Members

Abbott Machine Company has joined the International Thermal Spray Association.



Abbott Machine Company is your single source for quality used equipment. Abbott specializes in the rebuilding, remanufacturing, CNC retrofitting and servicing of quality boring mills and cylindrical roll grinders, and we rebuild, retrofit or remanufacture to any level necessary to satisfy your tolerance requirements. We can also perform installations and offer cost effective on-site service agreements for the machines in your plant. Abbott also offers an exceptional selection of equipment for sale, such as horizontal and vertical boring mills, roll grinders, lathes, rotary tables, presses and more. Engineered to fit your specific requirements, our selection of remanufactured machines perform as well as new, or better, and at a fraction of the cost.

Our Versagrind™ belt grinding attachments for grinding HVOF and other thermal spray coatings including chrome offer improved productivity, reduced cost and more profitability to our customers. If you want no chatter problems, finishes from 110 RA to 2-3 RA and tolerances to 0.0003, we can help. We will sell you a belt grinding attachment for your machine, or supply a complete grinder. We will also grind your parts in our plant. Our capacity is from 1/2 in. diameter to 60 in. X 264 in. CNC. You can see videos of our grinders in action on our website.

For more information, contact ITSA company representative Mike St. Peters, email: mike@abbottmachineco.com, or visit website www.abbottmachineco.com

Atlas Machine and Supply, Inc. has joined the International Thermal Spray Association.



Atlas Machine and Supply, Inc was founded in 1907. They are a multi-site industrial equipment repair company. The Atlas Machine core customer base includes steel, aluminum, power generation, and construction equipment industries; but they have vast experience repairing

equipment across a wide range of manufacturing industries. Atlas has a full service machine shop, weld shop, grind shop, engine rebuilding center and a thermal spray center. In their thermal spray center, they are currently spraying HVOF, Electric-Arc, Flame, and Plasma spray processes. Common applications for Atlas include roll body coatings for rolling mill components, piston rods, and engine blocks. Atlas has a full finishing capability for all of their spray processes with in-house grinding equipment. Atlas prides itself on quick lead times, and their ability to respond rapidly to equipment problems. They have 3 shifts and the ability to work around the clock to ensure their customers' problems get solved quickly.

For more information, contact ITSA company representative Richie Gimmel via email richie@atlasmachine.com or visit website www.atlasmachine.com

New Supporting Societies Members

ITSA is proud to welcome the following Supporting Societies into our membership:

AWS, The American Welding Society

JTSS, Japan Thermal Spray Society

MPIF, Metal Powder Industries Federation

See the complete ITSA member listing page 18.

ITSA Announces "Supporting Societies" Membership Category

The International Thermal Spray Association is pleased to announce a new "Supporting Societies" membership category to establish communication with other associations/societies involved in thermal spray and surface engineering activities worldwide.

This is an ideal method for membership exchange between organizations. If your organization is interested in a membership exchange to belong to the International Thermal Spray Association, please contact Kathy Dusa at the headquarters office via email to itsa@thermalspray.org

Join us in Chicago for the Thermal Spray Events at the Fabtech International & AWS Welding Show including Metalform November 15-18, 2009. This is North America's largest metal forming, fabricating and welding event!

What is Thermal Spray?

Free Tutorial

Sunday, November 15 • Registration Code: W10

Thermal Spray Conference

4 Sessions with 16 Speakers

Monday, November 16 • Registration Code: W22

Thermal Spray Pavilion Exhibitors

November 15-18 • Visit Aisle 30000

Visit www.fabtechexpo.com to Register

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A privately held industrial company seeks to acquire a metal coatings company with part finishing capability. Ideal offerings include HVOF, plasma spray, wire arc spray and vapor deposition coatings processes as well as a wide range of manufacturing services including CNC grinding, milling, turning, honing and buffing.

Interested parties should contact Eric Flyen at (701) 356.0814 or email to eflyen@gremada.com

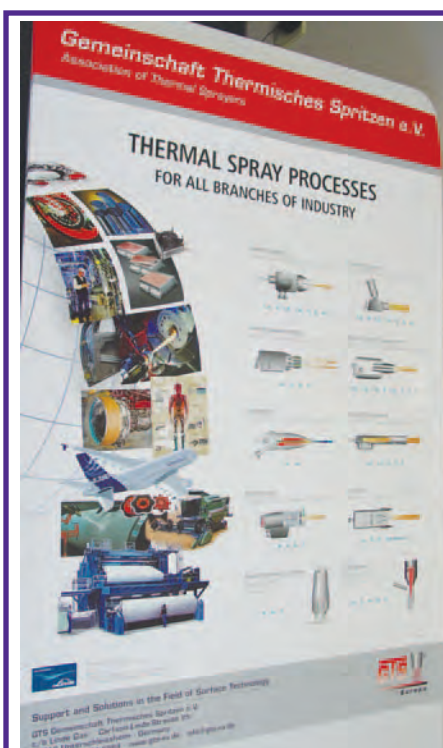


Sales Engineer Wanted

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Please send resume to t.wilmert@fstincusa.com



Free Poster

Free poster by Linde and the GTS (Association of Thermal Sprayers) which illustrates the different thermal spray processes (suitable for framing).

Send request for poster via email to itsa@thermalspray.org

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INDUSTRY NEWS

Thermal Spray Jobs

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For more information and to register for the "New Developments in Thermal Spray Coatings, Processes and Applications" Conference, visit www.fabtechexpo.com

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CALENDAR OF EVENTS

NOVEMBER 2009

3-5 Albuquerque, NM USA 2009 SVC Topical Conference - Society of Vacuum Coaters contact www.svc.org

5-6 Erding, Germany 8th Colloquium High Velocity Oxy-Fuel Flame Spraying - Visit GTS www.gts-ev.de, <http://hvof.gts-ev.de> or Linde AG www.lindegas.com

15-18 Chicago, IL USA **FABTECH Int'l & AWS Welding Show and Metalform- with a Thermal Spray Pavilion and Conference** - organized by American Welding Society, www.aws.org, Fabricators and Mfgs Assoc, www.fmafabtech.com, Soc. of Mfg. Engineers, www.sme.org/fabtech



FEBRUARY 2010

7-10 Phoenix, AZ USA PACE 2010 The Power of Paint & Coatings - visit www.pace2010.com

14-18 Seattle, WA USA TMS 2010 Linking Science and Technology for Global Solutions - TMS Meeting Services, tel: 724.776.9000 x243, email: mtgserv@tms.org, web: www.tms.org

10-12 Mumbai, India - 4th Essen Welding India with 4th International Trade Fair Joining, Cutting and Surfacing - Visit www.messe-essen.de

Is Your Event Listed? Send your event notice to spraytime@thermalspray.org

APRIL 2010

8-10 San Francisco, CA USA International Thermal Spray Association Membership Meeting and Technical Program - contact ITSA, itsa@thermalspray.org, 440.357.5400

17-22 Orlando, FL USA SVC Technical Conference - Society of Vacuum Coaters www.svc.org

19-22 Orlando, FL USA TechCon 2010 Society of Vacuum Coaters 53rd Annual Technical Conference - contact www.svc.org

21-24 Tokyo Japan Japan Int'l Welding Show 2010 sponsors include Japan Thermal Spraying Society - contact email: info@weldingshow.jp

MAY 2010

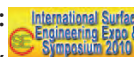
3-5 Singapore, Singapore ITSC 2010 International Thermal Spray Conference & Expo - contact ASM Int'l tel: 440.338.5151, web: www.asminternational.org, email: customerservice@asminternational.org



3-6 Pittsburgh, PA USA AISTech 2010 The Iron & Steel Technology Conference & Expo - web: www.aistech.org

JUNE 2010

7-9 Shanghai China - CISE 2010 International Surface Engineering Expo - contact E-mail: lulesong@126.com, bjmayushan@163.com, zdj1288@126.com, web: www.seexpo.net/EN/lxwm.htm



7-10 San Diego, CA USA MegaRust Navy Corrosion Conference - visit www.nstcenter.com

11-13 Mexico City, Mexico AWS Weldmex - visit www.aws.org

14-18 Glasgow, Scotland ASME Turbo Expo 2010 - Scottish Expo and Conference Center - visit www.turboexpo.org



15-17 Aachen, Germany 9th Int'l Conference on Brazing, High Temperature Brazing and Diffusion Bonding - contact DVS German Welding Society, tel: +49(0)211.1591.302, email: tagungen@dvs-hg.de, web: www.dvs-ev.de/loet2010

21-23 Bellevue, WA USA Aeromat 2010 Conference and Exposition Optimizing Performance and Affordability of Aerospace Materials - contact ASM Int'l tel: 440.338.5151, web: www.asminternational.org, email: customerservice@asminternational.org

27-30 Hollywood, FL USA - 2010 Int'l Conference on Powder Metallurgy & Particulate Materials - visit www.mpif.org

OCTOBER 2010

10-14 Florence, Italy Powder Metallurgy World Congress & Exhibition - visit www.epma.com/pm2010

NOVEMBER 2010

2-4 Atlanta, GA USA **FABTECH Int'l & AWS Welding Show and Metalform- with a Thermal Spray Pavilion and Conference** - organized by American Welding Society, www.aws.org, Fabricators and Mfgs Assoc, www.fmafabtech.com, Soc. of Mfg. Engineers, www.sme.org/fabtech



30NOV - 4DEC Boston, MA USA 2010 MRS Fall Meeting - visit www.mrs.org

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Society of Vacuum Coaters



If your work involves the use of vacuum coating, consider becoming a member of the Society of Vacuum Coaters (SVC). While many industries are struggling to find significance in today's economy, vacuum coating has discovered far reaching applications, spanning numerous industries and has positioned itself to be an integral part of tomorrow's technology.

Aside from these tangible benefits, SVC Members enjoy enhanced opportunities to interact with colleagues who are active in different aspects of vacuum coating.

Members also stay informed about the latest developments in PVD process technology.

SVC Membership benefits include:

- A discount on the registration fee for the annual Technical Conference
- One copy of the annual Technical Conference Proceedings CD-ROM, which contains manuscripts on the latest developments in vacuum coating science and technology
- A subscription to the SVC Bulletin (published three times each year)

- Technical advice from the SVC Technical Director
- Student Membership is available at the reduced rate of \$40. Persons under 31 years can join the Young Members Group for only \$40. Both groups can register for the TechCon at greatly reduced rates.

SVC Membership also includes access to the Member Login section of the SVC Web Site (www.svc.org) that provides the ability to:

- Update your contact information and search for members
- Access the on-line library of abstracts and manuscripts for the Technical Conference
- Access free downloads from the Document Shop for manuscripts from the Technical Conference Proceedings (2000-present) – available soon
- Access the three- to five-year SVC Strategic Plan – implemented in 2008
- Post a resume in the on-line Career Center

See page 17 for details on the SVC Annual Technical Conference scheduled for April 17-22, 2010 at the Orlando World Center Marriott Resort and Convention Center.

For more information, Join SVC for only \$99 at www.svc.org or call 505-856-7188.

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Tekna Advanced Materials Appoints Jim Ryan Director of Sales and Marketing

Tekna Advanced Materials (TAM), a new sister company of Tekna Plasma Systems inc., a world leader in induction plasma technology, has appointed **Jim Ryan** to the newly created position of Director of Sales and Marketing.

In his new post, Ryan will be responsible for all sales and marketing of TAM's growing powder business. TAM's new 25,000 ft² production plant located in Sherbrooke Canada is planned to be operational in January 2010 and will manufacture spherical and densified powders such as cast tungsten carbide, tungsten, tantalum, titanium as well as various types of nanopowders.

Ryan has 20 years of sales and marketing experience in the coating materials industry. He most recent position was as North American Business Manager for H. C. Starck (Newton, Mass.), with responsibilities of managing the sales and production activities of the Ceramics and Service Technology Group. He has also held sales and management positions with AIM-MRO and Praxair Surface Technologies.

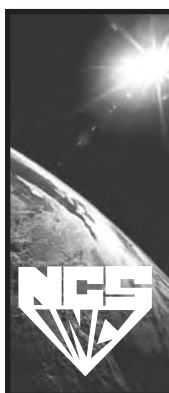
Ryan is a long-standing member of the International Thermal Spray Association (ITSA) and served as membership committee chairman (1997 – present). Jim is also a member of ASM International and the ASM Thermal Spray Society.

For more information, contact Jim Ryan via email: jhryan09@gmail.com



**International Thermal Spray Conference and
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www.asminternational.org/itsc

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Mo VandenBergh

Six Year Anniversary

June 1st marked the beginning of year 7 that VandenBergh and Associates (V&A) has been serving the thermal spray industry.

As from the beginning, the focus of VandenBergh and Associates efforts remains aiding the client in reducing costs through supply of quality parts and equipment, contracted audits and

measurements or consultation.

Always on the lookout for quality suppliers and associates to offer innovative and cost effective solutions, V&A has added several new products that will aid in reducing costs for thermal sprayers.

To existing product lines and services which includes:

- Alamo Supply Company, Inc. (flame spray equipment and supplies)
- Beckman Consulting LLC - (antistatic hoses and manipulation equipment)
- G-Tec Inc. (natural gas booster pumps)
- Oseir, Inc. (SprayWatch particle diagnostics equipment)
- SprayTech Engineering, LLC (thermal spray wires)
- Thermach, Inc. (thermal spray parts and equipment)

We have added:

- Ability to provide leased sales of equipment
- CoolClean, Inc - composite CO₂ surface cleaning and cooling equipment
- MicroDynamics Inc. - non-contact 2D and 3D surface measurement equipment for R&D and routine QC applications, www.MicroDynamics.net

For more information or an introduction to services, products and capabilities please contact Mo VandenBergh, tel: 317.718.8403, e-mail: mo_vandenbergh@earthlink.net or check out the web site: www.MoVandenBergh.com. You can also request V&A's Capabilities Presentation over Go-To-Meeting.

**Where is your employee news?
Send employee notice to
spraytime@thermalspray.org**

International Thermal Spray Launches New Website

The ITSA website now includes an "employment" and "for sale" area.

SPRAYTIME issues are included in this website with content search capability.

Visit www.thermalspray.org to see our new look and valuable industry information.

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