Robot Basics

The Importance of the Tool Center Point
by Richard S. Brunhouse, Peter Foy, Dale Moody

Many of the robots used for thermal spray operations are of the articulated type, configured much like the human arm and wrist where motions are via joints as opposed to slides. Such robots offer a lot of versatility but could be a problem to program if it were not for advanced robot programming and control software.

This paper provides a brief review on one important programmable parameter for articulated robots, the Tool Coordinate System. Even if you are not involved with robot programming, the information can be of benefit in understanding the basic principles used in automated Thermal Spray operations along with an understanding as to what can be achieved using a properly programmed robot.

To assist the programmer/operator, robot programs offer a number of coordinate systems that define the position and the attitude of the robot and of the tool being used.

Two of these are the World Coordinate System and the Tool Coordinate System (Figure 1). These coordinate systems use Cartesian nomenclature carried over from aircraft. The “X” axis is the forward direction while rotation about this axis is “R” or roll. Horizontal or side-to-side motion is along the “Y” axis and rotation about this axis is “P” or pitch. Vertical motion is along the “Z” axis and rotation about this axis is “W” or yaw.

Notice that, in this example, the gun is mounted next to the wrist and at an angle to limit the gun and cable load on the robot wrist. Also, this is a configuration that avoids singularities, a condition where two axes of the robot line up, causing program interpretation problems that could lead to an inadvertent shutdown. Figure 2 is of a Plasma Powders Corrospray Wire Spray Gun with offset mount in an RM-1000 Hood.

The Tool Coordinate System consists of two components, the Tool Frame and the Tool Center Point or TCP. The Tool Frame is made up of the three axes just discussed and the

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TCP is the origin of that frame. When the robot is instructed to move at a certain speed, it is the speed of the TCP that is controlled.

The World Coordinate System is fixed with respect to the robot and is not programmable. However, the Tool Coordinate System is programmable and can be “taught” for each “tool” or gun attached to the robot. In the past, a number of robot programmers used only the World Coordinate System or a default Tool Coordinate System. One instructor for thermal spray robot operations even stated that teaching the Tool Coordinate System was a waste of time. The purpose of this paper is to explain why that thinking is in error and to summarize the benefits of working with a properly set-up Tool Coordinate System. There are at least three benefits realized in using the Tool Coordinate System.

First, it speeds up programming

Consider a Tool Frame and TCP for a thermal spray operation. As noted in Figure 1, the TCP is programmed to be the spot or the deposit point of the spray process. This is at the stand-off distance from the face of the thermal spray gun. This distance can vary from an inch for a plasma operation to feet for an arc process.

In developing a robot program, the programmer is interested in the relationship of the gun and the workpiece. Using the Tool Frame as shown for the Thermal Spray Gun, the programmer can easily jog the gun along the gun axis to reach the proper standoff. The programmer only has to move the gun along the “X” Axis (single button control). If the World or default Tool coordinate system were used, the programmer would have to alternately jog between the three axes in order to position the gun.

Second, programming is simpler

In multiple pass coating a sheet as shown in Figure 1, each pass of the gun is offset from the previous path. One way to achieve this is to program each path, i.e. a separate motion instruction for each path. An easier way is to use only one motion instruction in a repetitive loop and incrementally introduce an offset in the “Z” direction after each pass. This is only possible if the Tool Frame has been defined.

Third, the build is more accurate

A more important argument for using the correct TCP has to do with the build. Figure 3 is an example where a coating is required on a curved surface. To achieve the required thickness, assume that the gun needs to traverse across the plate at a speed of 10 mm/sec. Where the plate is flat, this is easily understood. However, where a curve is encountered such as in figure 3, the gun is moving at a different rate than the speed of the spot or point of application. In this figure, the center of the wrist flange travels 20 mm while the spray plume or spot travels only 10 mm along the curve. If the default TCP (center of the wrist flange) was used by the programmer, the robot would be controlling the speed of the flange and not the speed at the point of application. The spot travel speed in the area of the curve would drop by half, resulting in a build double of that in the flat sections of the sheet. This would produce an unsatisfactory build.

Programming the Tool Coordinate System

Is it difficult to program a Tool Coordinate System? Not really. Modern articulated robots step the operator through

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the program for a Tool Coordinate System. Programming the Tool Frame and TCP is achieved by placing a straw or other object in the gun to represent the stand-off distance. The robot is then jogged to cause the tip of the straw to touch a singular point from three different positions, and by pressing an “accept” key, it records the gun coordinates for each. The robot can then calculate the TCP for the gun being used. The frame is then defined by moving the gun from the given spot in the “X” direction and then in the “Z” direction and recording the result for each motion. The robot uses that information whenever that tool frame is selected.

As indicated, the Tool Coordinate System can be a powerful tool. It is worth while to become familiar with it and to use it regularly for each Thermal Spray Gun used in a robotic process.

For more information, contact author Dale Moody via email DaleRMoody@aol.com.

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Gartner has approximately 115 employees at two ISO 9001 accredited facilities in the Houston, TX area and had sales of approximately $24 million in 2012. Going forward, the facilities will continue to do business as F.W. Gartner Thermal Spraying and operate within the Curtiss-Wright Surface Technologies business segment.

About Curtiss-Wright Surface Technologies Segment:

The Curtiss-Wright Surface Technologies (“CWST”) business segment provides precision shot peening, laser peening, engineered coating and analytical testing services to the aerospace, power generation, transportation and other demanding general industrial markets through a global network of 70 locations. For more information, visit www.cwst.com.

About Curtiss-Wright Corporation:

Curtiss-Wright Corporation is an innovative engineering company that provides highly engineered, critical function products, systems and services in the areas of flow control, motion control and surface treatment technologies to the defense, energy and commercial/industrial markets. The legacy company of Glenn Curtiss and the Wright brothers, Curtiss-Wright has a long tradition of design and manufacturing innovation along with long-standing customer relationships. The company employs approximately 9,700 people worldwide. For more information, visit www.curtisswright.com.

About F.W. Gartner Thermal Spraying:

A leading, global provider of surface engineering solutions, FW Gartner is certified to ISO 9001:2008

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For more F.W. Gartner information, visit www.fwghts.com
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History: Stellite is recognized around the world as being synonymous with cobalt-based alloys. In 1907, Deloro Smelting and Refining Company was set up by Michael John O’Brien and Elwood Haynes in the small Canadian cobalt mining village of Deloro. When Haynes left in 1912 to focus on nickel-based components, O’Brien formed Deloro Stellite to produce cobalt-based Stellite alloys.

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the plant shuts down or starts up, MSBVs are operated and exposed to supercritical steam operating conditions.

The MSBVs in question were of a floating ball design with a fixed seat, manufactured from forged Inconel® 718 PH and coated with a HVOF 80% Cr3C2 + 20% NiCr coating. This coating failed after 1 year and less than 500 mechanical cycles in service on balls exposed to supercritical steam, with deterioration extending to regions where there is no contact between ball and seats. Visual examination of damaged components revealed minor frictional wear and typical stress/fatigue pattern.

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Armed with these new coating technologies, new valves were installed in the plant. They have worked flawlessly for the past year. As a result, the valve manufacturer’s MSBV line for the power industry now features two coatings: one designed for regular service - HVOF (W,Cr)C-Ni and one specially designed for applications involving severe thermal shocks - S&F NiWCrBSi.

For more information, visit http://stellite.com

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**United Surface Technologies** - Altona, Melbourne Australia  
61.393.98.5925  
Mr. Keith Moore, keith.moore@ust.com.au

**SUPPORT MEMBER COMPANIES**

**3M Abrasive Systems Division** - St. Paul, MN USA  
www.mmm.com  800.362.3550 or 651.736.4970  
Mr. Nick Orf, naorf2@mmm.com

**Advanced Material Services** - West Chester, OH USA  
513.907.8510  
Mr. Jim Ryan, jryan-ams@cinci.rr.com

**ArcMelt** - Bridgeton, MO USA  
www.arcmelt.com  314.801.6900  
Mr. David Urevich, durevich@arcmelt.com

**AMETEK, Inc.** - Eighty-Four, PA USA  
www.ametek.com  724-252-8400  
Ms. Cindy Freeby, cindy.freeby@ametek.com

**Ardleigh Minerals, Inc.** - Shaker Heights, OH 44122 USA  
www.ardleigh.com  216.464.2300  
Mr. Ernie Petrey, epetrey@ardleigh.net

**Bay State Surface Technologies, Inc.** - Auburn, MA USA  
www.baystatesurfacetech.com  508.832.5035  
Mr. Jay Kapur, jkapur@aimtek.com

**Camfil Farr APC** - Jonesboro, AR USA  
www.farrapc.com  800.479.6801  
Mr. Dale Gilbert, gilbertd@farrapc.com

**SPRAY TIME** Fourth Quarter 2012
The International Thermal Spray Association is closely interwoven with the history of thermal spray development in this hemisphere. Founded in 1948, and once known as Metallizing Service Contractors, the association has been closely tied to most major advances in thermal spray technology, equipment and materials, industry events, education, standards and market development.

A company-member association, ITSA invites all interested companies to talk with our officers, and company representatives to better understand member benefits. A complete list of ITSA member companies and their representatives can be found at www.thermalspray.org

**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.

**Officers**

Chairman: **David Wright**, Accuwright Industries, Inc.
Vice-Chairman: **Jason Falzon**, FW Gartner Thermal Spraying
Treasurer: **Bill Mosier**, Polymet Corporation
Corporate Secretary: **Kathy Dusa**

**Executive Committee** (above officers plus the following)

**Dan Hayden**, Hayden Corporation

**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, OH and the State University of New York at Stony Brook in the Thermal Spray Research Center, 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 historic thermal spray publications and reference books.

Future plans include a virtual tour of the collection on the ITSA website for the entire global community to visit.

This is a worldwide industry collection and we welcome donations from the entire thermal spray community.

**ITSA SPRAYTIME 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. This newsletter is free and can be viewed online at www.spraytime.org.

**ITSA Headquarters**

**N E W  A D D R E S S**

Post Office Box 1638, Painesville, OH 44077 USA
voice/cell: 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 (ITSA) now! As a company-member, professional industrial association, our mission is dedicated to expanding the use of thermal spray technologies for the benefit of industry and society.

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

**New - All ITSA company members are now also Supporting Members of the American Welding Society which includes five individual AWS memberships.**

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 Thermal Spray Pavilion and Conference, Fabtech Mexico, Power-Gen, Society of Vacuum Coaters (SVC), TurboMachinery, NACE and TurboExpo).

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 ITSA headquarters office, phone 440.357.5400 or visit the membership section at www.thermalspray.org.

Thermal Spray Jobs listed at “For Hire” www.thermalspray.org

International Thermal Spray Association Welcomes New Member

Globe Metal, Inc. has joined the International Thermal Spray Association.

Since 1974 Globe Metal, Inc. has been in the business of recycling metal. We specialize in extracting valuable metals from industrial generated wastes such as metal powders, metallic sludge, grinding swarf, filter cake, metal fines and metal dust. We also specialize in recycling high temperature alloys, tungsten carbide, stainless steel and nickel scrap.

We buy all grades of ferrous and non-ferrous scrap, spent catalysts, grinding swarf, metal powders, oversprays and thermal spray wastes.

We are a scrap metal company, specializing in the processing of all industrially generated metals, high temperature alloy scrap, tungsten carbide scrap in solid or sludge form, tantalum scrap, high speed tool steel scrap as well as powders and oversprays containing nickel, cobalt and molybdenum.

We operate a fully paved, modern processing facility where we package our finished product for direct shipment to various consumers worldwide. Our paved yard helps protect the environment while giving our customers peace of mind in knowing the highest environmental protection standards are being maintained on their behalf. Since 1975, we have helped our customers maximize the value of their scrap metals by providing a more direct access to the marketplace, as well as showing them how to save costs in the handling of their various scrap materials in plant.

Our equipment consists of specially designed leak proof tote boxes and various other material handling devices that help our customers save money in the handling of scrap in their plants as well as protecting the environment from coolant spills and contamination.

Our aim is to tailor a specific program suited to your individual needs!

For more information, contact ITSA company representative Adam Rubin, adam@globemetal.com and visit website www.globemetal.com

NEW “Supporting Societies” Membership

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.

See the Supporting Societies listing on page 15.

This is ideal for membership exchange between organizations. Contact Kathy Dusa at the headquarters office via email to itsa@thermalspray.org
Praxair Surface Technologies Introduces New High Performance Inorganic, Zinc-Rich Sacrificial Coating

Most conventional zinc platings fail within just a few hundred hours of salt spray exposure tests. Praxair’s new, Zinc rich, Water-based Sacrificial Coating shows no red rust and significantly diminished formation of white corrosion products after 3,600+ hours of salt spray exposure.

Scribed carbon steel panel showing no red rust after 3,600 hours of neutral salt spray testing per ASTM B1117.

The coating is stable at temperatures up to 750°F (400°C), impervious to brake-fluids, grease and solvents and can be applied to powder metallurgy parts. Additional benefits include a zero VOC and chrome free formulation. The coating process also allows flexibility for an air dry or lower temperature cure process for certain applications.

For more information, phone +1 317.246.2756 or contact Anand Samant email anand_samant@praxair.com

Scholarship Opportunity

Since 1991, the International Thermal Spray Scholarship Program has contributed to the growth of the thermal spray community. ITSA offers up to three Graduate Scholarships worth $2,000.00 each.

Applications accepted April 15 through June 30 ONLY. Please visit www.thermalspray.org scholarship area for details and a printable application form.

Become a Member of the International Thermal Spray Association

Your company should join the International Thermal Spray Association (ITSA) now! As a company-member professional industrial association, our mission is dedicated to expanding the use of thermal spray technologies for the benefit of industry and society. ITSA members invite and welcome your company to join us in this endeavor. See pages 14-17.

North America’s largest metal forming, fabricating, welding and finishing event will be held at the North and South Halls of McCormick Place, Chicago, Illinois, USA, November 18-21, 2013. The upcoming event is expected to cover more than 500,000 net square feet and anticipates over 35,000 attendees and 1,200 exhibiting companies.

Thermal Spray Pavilion

Join the International Thermal Spray Association at the Fabtech Thermal Spray Pavilion this year in Chicago.

To reserve your booth space, contact Joe Krall, 800.443.9353 x 297 or email jkrall@aws.org.

For event information, visit www.fabtechexpo.com.

Where is your article? We encourage you to send articles, news, announcements and information to spraytime@thermalspray.org.
BOOK REVIEW

Handbook for Critical Cleaning 2nd Edition is a comprehensive reference book that approaches cleaning from many different perspectives. The book is divided into two parts: Cleaning Agents and Systems, and Applications, Processes, and Controls. Each volume is written by experienced authors who have working expertise in their respective fields. There are more than 70 contributing authors from different walks of life including academic, government, pharmaceutical, medical and medical implants, chemical, thermospray, safety, aerospace, film, and art restoration. There are more than 1,000 pages which include glossaries, indices, bios, tables and formulas. Critical Cleaning is edited in such a way that the diverse disciplines overlap, and each chapter has something to offer the whole. Its strongest feature is the clear explanation of solvents and how they work in the cleaning process. Also interesting is the chapter on Regulations written from a regulator’s perspective. The explanation on ultrasonics is particularly in depth.

In my opinion, it’s more pragmatic than a textbook, and this is why I keep Barbara and Edward Kanegsberg’s book in my reference library where I can find formulas and charts quickly. I would recommend it for those that are going to buy equipment, have a need to know the chemical structure of solvents, and those who are working in thermospray who need to know what solvent to use to clean different metals. Critical Cleaning is truly a handbook as it has a workman’s knowledge of the subject that is useful for technicians and engineers. It is also a sophisticated and in depth tool for working scientists.

For more information, visit www.bfkolutions.com or contact author Barbara Kanegsberg via email barbara@bfksolutions.com or contact reviewer Steve Norris via email s.norris@ptise.com

ISBN 9781439828267. List price for the set of two books is $179.95. Can be purchased through CRC Press or major online booksellers. Spraytime readers can save 20%, with free shipping, if they email us; we will send them a discount code to order through CRC Press. They can also reach us by clicking the image of the books on the home page of our website, bfksolutions.com.

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Praxair Surface Technologies Signs Long-Term Agreement with Messier-Bugatti-Dowty for Airframe Coatings in Asia

Praxair Surface Technologies, Inc. a wholly-owned subsidiary of Praxair, Inc. (NYSE: PX), has entered into a 10-year agreement with Messier-Bugatti-Dowty (Safran Group) for thermal spray coating services to replace chrome plating on major airframe component programs.

Praxair will commission an airframe production line in its Changzhou, China facility for thermal spray coating and finishing services as well as a coating production cell in Changwon, South Korea for applying automated thermal spray coatings and metallic slurries. Production is expected to commence in 2013.

“Praxair’s participation in this project is essential for Messier-Bugatti-Dowty to produce high-quality, environmentally-responsible airframe components with complex geometry for leading aircraft major programs,” said Henri Koffel, vice president of Purchasing for Messier-Bugatti-Dowty. “Once again, Praxair has proven itself as a reliable, technologically advanced supplier who has invested in our combined success.”

“Praxair is pleased to expand production in Asia for Messier-Bugatti-Dowty and the Safran Group,” said Mark Murphy, president of Praxair Surface Technologies. “Through our advanced coating technologies, broad range capabilities in Asia, and global production excellence, we’re uniquely positioned to support Messier-Bugatti-Dowty’s production of more environmentally-friendly aircraft components.”

Praxair provides airframe coating services to Messier-Bugatti-Dowty through its production facilities in Canada, France, and the United Kingdom. The company’s China and South Korea coating centers are part of a global network of advanced coatings facilities that utilize leading technologies and apply best-in-class safety and quality principles.

About Praxair Surface Technologies: Praxair Surface Technologies offers a comprehensive slate of high-performance coatings and technologies to aviation, industrial gas turbine, oil and gas, and other markets. By continuously advancing coatings technologies, Praxair Surface Technologies helps customers improve environmental performance, decrease energy consumption, extend component life, improve productivity, minimize downtime, reduce operating costs, and produce higher quality products.

Praxair, Inc. is the largest industrial gases company in North and South America, and one of the largest worldwide, with 2011 sales of $11 billion. The company produces, sells and distributes atmospheric, process and specialty gases, and high-performance surface coatings. Praxair products, services and technologies are making our planet more productive by bringing efficiency and environmental benefits to a wide variety of industries, including aerospace, chemicals, food and beverage, electronics, energy, healthcare, manufacturing, metals and others.

For more information, visit www.praxair.com.

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13-15 Orlando, FL USA  Above Ground Storage Tank Conference and Trade Show - contact Jim DeMartini 800.827.3515 or email jdemartini@nistm.org
17-21 Orlando, FL USA  Corrosion 2013 - visit www.nace.org
17-21 Doha, Qatar  Middle East Turbomachinery Symposium - contact turbolab@tamu.edu.
19-21 Long Beach, CA USA  AERODEF Manufacturing Aerospace and Defense Manufacturing - visit aerodefevent.com

APRIL 2013
3-4 Bellevue, WA USA  North American Cold Spray Conference- visit www.asminternational.org “events”
2-5 Bellevue, WA USA  AeroMat Conference and Expo - contact www.asminternational.org/aeromat
3--5 Kyiv, Ukraine  Kyiv Technical Trade Show 2013 - For wire and tube industry, surface preparation and sheet metal industry - visit www.weldexpo.com.ua
20-25 Providence, RI USA  SVC TechCon 2013 Vacuum Coating and Surface Engineering - visit www.svc.org

MAY 2013
5-8 Helsingor, Denmark  Int’l conference on Joining Materials JOM 17 - contact jom_awx@post10.tele.dk
6-8 Goregon, Mumbai, India  Power-Gen India and Central Asia - visit www.power-genindia.com
6-9 Houston, TX USA  OTC2013 Offshore Technology Conference - visit otcnet.org/2013
7-9 Monterrey, Mexico  5th Fabtech Mexico - visit fabtechmexico.com

JUNE 2013
4-6 Edmonton, Alberta Canada  Western Manufacturing Technology Show and Weld Expo Canada - visit www.wmts.ca
4-6 Vienna, Austria  Power-Gen Europe - visit www.powergeneurope.com

June 6-8 Ogden, UT USA  International Thermal Spray Association Annual Membership Meeting - email itsa@thermalspray.org

2-5 Bellevue, WA USA  North American Cold Spray Conference - visit www.asminternational.org “events”

SEPTEMBER 2013
16-21 Essen, Germany  Int’l Trade Fair Joining Cutting Surfacing - visit www.schweissen-schneiden.com
24-26 São Paulo, Brazil  Power-Gen Brazil - www.powergenbrasil.com
30 SEP-3 OCT Hamburg, Germany  ASME 2013 Turbine Blade Tip Symposium & Course Week - email igtiprogram@asm.org

OCTOBER 2013
1-4 São Paulo, Brazil  Brazil Welding Show and Congress - visit www.brazil-welding-show.com
2-4 Bangkok, Thailand  Power-Gen Asia - visit www.powergenasia.com
27-31 Montreal, Quebec, Canada  Materials Science and Technology Conference and Exposition (MS&T) 2013 - visit www.asminternational.org “events”

NOVEMBER 2013
12-14 Orlando, FL USA  Power-Gen 2013 - visit www.power-gen.com
TBD Chicago, IL USA  FABTECH with a Thermal Spray Pavilion and Conference - visit www.fabtechexpo.com

2014
MARCH 2014
9-13 San Antonio, TX USA  Corrosion 2014 - visit www.nace.org
17-19 Cape Town, South Africa  Power-Gen Africa - visit www.powergenafrica.com

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

Become a Member of the International Thermal Spray Association

Your company should join the International Thermal Spray Association (ITSA) now! As a company-member professional industrial association, our mission is dedicated to expanding the use of thermal spray technologies for the benefit of industry and society.

ITSA members invite and welcome your company to join us in this endeavor. See pages 14-17.
Bringing Together the Best in Vacuum Coating and Surface Engineering Technologies

Join the Society of Vacuum Coaters in the heart of New England’s “Technology Corridor” for the 56th Annual Technical Conference, Exhibit, Education Program and Networking events.

Technical Program
This annual international conference features two application-specific themes which are embodied by our symposia on “Coatings and Surface Treatments for Medical Applications” and “Thin Films for Photovoltaics and Batteries.” These and other topics will be explored in our 12 Traditional Sessions, a two-day Technology Exhibit, a comprehensive Education Program, and a variety of networking events that link innovation with business.

Technology Exhibit
This “Technology Corridor” is exploding with industrial, technical and academic facilities, making this venue for the 2013 TechCon Exhibit the perfect venue to join researchers with coating, process and equipment experts utilizing a wide variety of applications.

2013 TechCon Education Program
Choose from 26 Tutorial Courses in Providence
This extensive educational offering covers a broad spectrum of vacuum technology – from introductory level subjects to specialized topics.

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**SULZER**

Sulzer Metco Strengthens Presence in Russia

Sulzer Metco announces the completion of the acquisition of Russian company, Protective Coatings LLC, formerly SP Technicord LLC, as of December 18th, 2012. With this acquisition, Sulzer Metco expands its geographical and technology presence, and will benefit from long-term growth trends in selective Russian industrial markets.

The acquired company, located in the Moscow region, employs a well-experienced team recognized as local specialists in manufacturing of materials for thermal spray and hard surfacing applications. In addition, they offer innovative solutions for new materials and equipment as well as coating services.

"With this acquisition," said Cesar Montenegro, President of Sulzer Metco, "we take a further step towards the implementation of our strategy to strengthen our position in emerging markets. Russia offers substantial growth potential for Sulzer, particularly in oil and gas, power generation, transportation and general industry. Our surface technology solutions in general and the thermal spray processes in particular have proven successful in these markets."

"Through this acquisition we establish a local presence and the foundation to build up Sulzer Metco Russia to provide direct sales and services to customers in Russia," added Howard Lang, Executive Vice President Sales and Marketing.

Sulzer Metco enhances surfaces with coating solutions and equipment. Customers benefit from a uniquely broad range of surface technologies, coating solutions, equipment, materials, services, and specialized machining services and components. The innovative solutions improve performance and increase efficiency and reliability. Sulzer Metco serves industries such as power generation.

For more information, visit www.sulzer.com

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**FABTECH**

North America’s largest metal forming, fabricating, welding and finishing event will be held at the North and South Halls of McCormick Place, Chicago, Illinois, USA, November 18-21, 2013. The upcoming event is expected to cover more than 500,000 net square feet and anticipates over 35,000 attendees and 1,200 exhibiting companies.

**Thermal Spray Pavilion**

Join the International Thermal Spray Association at the Fabtech Thermal Spray Pavilion this year in Chicago.

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**Where is your article?** We encourage you to send articles, news, announcements and information to spraytime@thermalspray.org.

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**Finishing Online Website**

Includes Thermal Spray

The website "Finishing Online" (www.finishingonline.com) now includes "thermal spray" in their "industries" area. Go to their website to register and get your free listing.

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Colour Matching in Decorative Thermally Sprayed Glass Coatings

Thierry Poirier, Pierre Bertrand, and Christian Coddet

Coloured coatings were obtained on steel by plasma spraying without severe in-flight alteration of pigments, taking profit of the low thermal conductivity of the glassy matrix of glaze particles. Colour matching was studied by mixing 3 different glazes, comparing Grassmann and Kubelka-Munk based algorithms. Results suggest that the latter method should be preferred upon Grassmann method, particularly when the light absorption/ dispersion ratios of coloured feedstocks are very different.

Read the entire article in the February 2013 Issue
Visit www.asminternational.org/tss

Editor: Christian Moreau • Lead Editor: Basil Marple
Editor Emeritus: Christopher C. Berndt
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Kendall Hollis, Seiji Kuroda, Chang-Jiu Li, and Armelle Vardelle
in the United States Marine Corps. He had two combat
deployments with an attack helicopter squadron and
unmanned aerial vehicle squadron.

**About Wall Colmonoy:** Wall Colmonoy is a global materials engineering group of companies engaged in the manufacturing of surfacing and brazing products, castings, and engineered components across aerospace, automotive, oil and gas, mining, energy and other industrial sectors.

Known for our unique proven way of creating superior performing alloys that enhance engineered components, we pride ourselves on long-term strategic customer collaboration that produces value-added ideas and creative solutions.

Combining over 70 years of engineering technology with a progressive, visionary outlook, Wall Colmonoy offers customers trusted, customized expertise that results in smart innovation and shared growth.


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**Thermal Spray Technologies Signs Statement Of Support For National Guard and Reserve**

The Statement of Support confirms that Thermal Spray Technologies joins in demonstrating support for our armed forces, pledging that

*We fully recognize, honor and enforce the Uniformed Services Employment and Reemployment Rights Act (USERRA).*

*Our managers and supervisors will have the tools they need to effectively manage those employees who serve in the National Guard and Reserve.*

*We will continually recognize and support our country’s service members and their families in peace, in crisis and in war.*

Thermal Spray Technologies stands proudly with its Guard and Reserve employees who continue to answer their

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**Thermal Spray Technologies Receives Patriot Award**

Thermal Spray Technologies was recognized by the Department of Defense for extraordinary support of employees who serve in the Wisconsin National Guard and Reserve.

In a ceremony at Thermal Spray Technologies today, the Wisconsin Committee for Employer Support of the Guard and Reserve (ESGR), an agency of the Department of Defense, presented the Patriot Award to Thermal Spray Technologies in recognition of extraordinary support of one of their team members – Specialist Brandon J. Reilly, 485th Engineer Company, US Army Reserve.

According to Fred McCormick, Wisconsin’s ESGR Chair Emeritus, who presented the award, “The Patriot Award was created by ESGR to publicly recognize those who publicly provide outstanding patriotic support and cooperation to their employees, who like the citizen warriors before them have, have answered their nation’s call to serve. Thermal Spray Technologies was nominated for being highly supportive of the US Army Reserve and Specialist Reilly. Supportive supervisors and co-workers are critical to maintaining the strength and readiness of the nation’s National Guard and Reserve units.”

“We are proud to support our team members in the National Guard and Reserve, as well as everyone who has served in the armed forces. We enjoy our freedom because of their sacrifices”, said Andrea Loppnow, Division Manager – Industrial Products.

**For more information**, visit www.tstcoatings.com

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