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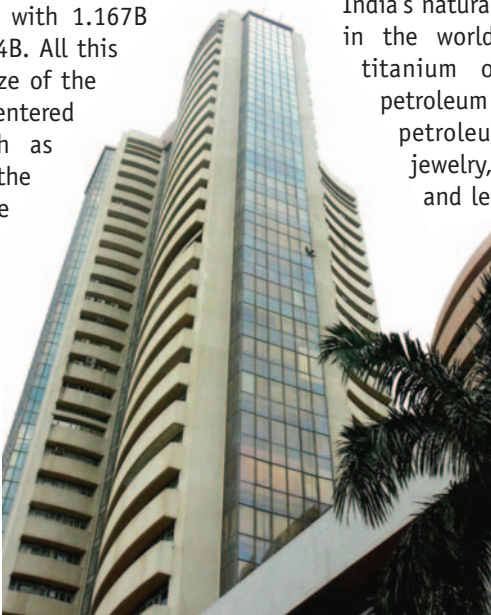
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## India: Land of Cultural Diversity; Land of Opportunity

*by Jean Mozolic*

When you think of India what comes to mind? Perhaps it is Gandhi, the Taj Mahal, Bollywood, the food and the dress to name a few. However, India is also the largest democracy and the second most populous country in the world with 1.167B people compared to China's 1.34B. All this in a land mass one-third the size of the US. Much of this population is centered around the major cities such as Mumbai, Delhi and Kolkata in the north and Hyderabad, Bangalore and Chennai in the southeast. These cities are teeming with the energy and the problems associated with such a large population. Traffic is heavy with cars, trucks, buses, bicycles, jitneys and taxis sharing the same space with pedestrians. Horns are constantly blaring. The poorest to the richest share the streets and the roads. Construction, growth and expansion are everywhere.

India is a country and a culture in transition. It has over 500M people in the workforce and a growing middle class of 350M people. The median age is 25 as compared to 34 for China, 37 for the US and 44 for Germany. The literacy rate is 61%. The average life expectancy is 70. GDP is \$3.27T with a 2009 projected rate of 6.6%. This compares to \$7.8T and 9.8%



**The Bombay Stock Exchange, in Mumbai, is Asia's oldest and India's largest stock exchange.**

for China; and, \$14.29T and 1.8% for the US. Major legal and taxation overhaul is ongoing with the goal of attracting foreign investment. Many Indian industries and companies permit 100% foreign direct investment.

India's natural resources include coal (4th largest reserve in the world), iron ore, manganese, mica, bauxite, titanium ore, chromite, natural gas, diamonds, petroleum and limestone. Its primary exports include petroleum products, textile goods, gems and jewelry, engineering goods and services, chemicals and leather goods exceeding \$176B in 2008. The

US is India's largest market followed by UAE, China, Singapore, UK and Hong Kong. India imports reached \$288B in 2008 and included crude oil, machinery, gems, fertilizer and chemicals. India's net imports far exceed its exports. As a result it will remain a strong and growing market for a variety of products including thermal spray consumables, equipment, spare parts and services.

Even though the country has 14 official languages, English is the language of business. The impact of former British rule is evident in India's legal system, government, communication style and business practices. Communication can be subtle, polite and formal. Trust needs to be earned but once it is you have not only a business partner but a friend for life. To be successful in India you must understand its history, its culture, the impact of religion, its intelligence, its spirit and its pride.

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### Industry Overview

The thermal spray industry in India continues to grow and diversify just as India's business base is. The industry initially served such markets as pulp and paper, steel and mining. This has continued to expand to include automotive, aerospace, nuclear, power and medical. Even though a separate thermal society does not yet exist, ASM International "www.asminternational.org", has been active in India since 1979 with offices in Mumbai, Delhi and Chennai.

The Indian Institute of Welding "www.iiwindia.com" is another major organization that attracts surface technology experts from academia and industry. It is important to understand the various market segments to understand the significance and growth of the Indian thermal spray market. The following are highlights from several critical industries within India.

### Automotive

The automotive industry in India is one of the largest industries and a key sector of the economy. At present, India is the world's:

- Largest tractor and three-wheel vehicle producer
- Second largest two-wheel vehicle producer

- Fourth largest commercial vehicle producer
- Eleventh largest passenger car producer.

Tata Industries www.tatamotors.com announced in March of this year the launch of the world's least expensive car



India Tata Nano Automobile.

'The Nano'. Priced at less than \$2500 it is within reach of India's growing middle class. This car will be produced entirely in India and Tata has plans to sell it into select foreign markets.

The Tata Nano is currently being manufactured at the company's Pantnagar plant in Uttarakhand in limited numbers. The new dedicated plant, at Sanand in Gujarat, will be ready in 2010 with an annualized capacity of 350,000 cars. Eventually, Tata

predicts its Nano factory will generate 10,000 jobs both directly and indirectly.

Among the car companies that are investing in India are US automakers General Motors and Ford, Germany's BMW and Daimler AG, France's Renault, Japan's Suzuki, Toyota and Honda, and South Korea's Hyundai. The Indian automotive industry was born in 1991 with the government's de-licensing of the sector and subsequent opening up for 100 per cent 'Foreign Direct Investment' (FDI). Production of vehicles rose from 2 million in 1991 to 9.7 million in 2006.

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There is also a boom in auto ancillary companies. India is an attractive outsourcing destination for global auto companies because of its strong engineering skills and low costs. Sourcing parts from India is 10-20% cheaper for US auto makers and about 50% cheaper for their European counterparts.

- This industry grew by over 28% between 1995 and 1998, and has been sustaining double digit growth with 16% in 2004-05 and 15% in 2005-06.
- The Indian auto component industry is quite comprehensive with around 500 firms in the organized sector producing practically all automotive components; there are more than 10,000 firms total. As an example, India is home to several large piston ring companies including Goetze India, IP Rings, Menon Pistons and Samkrig Pistons. These companies have in-house coating and machining capability to process the standard Mo/Ni self-fluxing materials.
- India's component industry now has the capability to manufacture the entire range of auto components, for example, engine parts, drive, transmission parts, suspension and braking parts, electrical systems, body



The Sukhoi-30 MKI is the Indian Air Force's prime air superiority fighter and an enhanced version of Su-27.

and chassis parts, equipment, etc.

### Aerospace

February 11-15 of this year, India hosted its 7th biannual "Aero India" in Bangalore "www.aeroindia.in". This drew 592 exhibitors from 25 countries including China, Germany, the Netherlands, Belgium, Russia, France, Australia, the UK, US and Brazil. Notable companies and agencies included GE, UTC, SNECMA, Bell Helicopter, Textron, Honeywell, Saab, Dassault, the DOD and the USAF. The largest foreign presence was from Boeing and a varied United States contingent. This conference attracted over 50,000 business visitors and over 250,000 general visitors.

Indian carriers currently have a fleet size of 310 aircraft with an additional 480 aircraft on order, scheduled for delivery by 2012. 900-1000 commercial aircraft worth \$100B are expected to be delivered in the next 20 years. \$25B will be spent in the next 5 years. The Defense Industry is planning \$100B in expenditures in the next 5 years. 15-20% will be spent on aircraft.

Later this year an International Maintenance and Repair Conference is being held in Hyderabad from November 20-22 "www.imroshow.com". The major commercial Indian airlines include Kingfisher Air, Air Deccan, Jet Airways, Air

## INDUSTRY NEWS

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India, Indigo and Spice Jet. 80% of the required airframe maintenance is already being done by these airlines directly. India's MRO business is expected to grow 15% per year and reach \$1.17B by 2010 and \$2.6B by 2020.

Several of the major companies involved in this industry include:

- Hindustan Aeronautics LTD (HAL) "www.hal-india.com" with 19 Production facilities and 9 R&D Centers in 7 locations in India. HAL has manufactured over 3550 aircraft, 3600 engines and overhauled over 8150 aircraft and 27300 engines. 2007 turnover was \$1.558B.
- Bharat Electronics LTD (BEL) "www.bel-india.com" established in Bangalore, India, by the Government of India under the Ministry of Defense in 1954 to meet the country's specialized electronic needs. BEL has 9 sites throughout India manufacturing a variety of electronics and avionics including communications, radar, sonar, thermal imaging, batteries (Ni-Cd, Mg, LiSO<sub>2</sub>), simulators. 2008 turnover was \$925M.
- Bharat Dynamics (BDL) "http://bdl.ap.nic.in" with two complexes in Hyderabad and Bhanur was established in the year 1970 to be a manufacturing base for guided weapon systems. BDL's initial product was a 1st generation AntiTank Guided Missile (ATGM) - the French SS11B1. This product was a culmination of a license agreement between the Government of India and Aerospatiale, France. The company continues to produce ATGMs as well as surface-surface missiles, airborne and marine countermeasure systems. 2008 turnover was \$90.87M.
- Mishra Dhatu Nigam LTD (Midhani) "www.midhani.com" headquartered in Hyderabad produces a wide range of superalloys, titanium, specialty steels and a variety of metals and alloys for the aerospace, defense, nuclear energy, power generation, chemical and biomedical industries. 2008 turnover was \$73.9M.
- Jupiter Strategic Technologies Pvt LTD (JST) "www.jupiterstrattech.com". JST is positioning itself as one-stop shopping for the aerospace industry (excluding airframe). It is making major investments in MRO facilities and is currently doing MRO for Airbus and Boeing. JST is a diversified company with activities in avionics; electronic warfare programs; infrastructure including transportation and logistics, airports and seaports, power; Maintenance and support infrastructure for commercial aircraft; commercial aviation and engineering training; secured networks and communications systems for homeland security.

#### **Pulp and Paper, Steel, Information Technology (IT)**

The Paper industry in India is the 15th largest paper industry in the world. It provides employment to nearly 1.5 million people and contributes \$625M to the government's kitty. The government regards the paper industry as one of the 35 high priority industries of the country. In 1951, there were 17 paper mills, and today there are about 515 units engaged in the manufacture of paper and paperboards and newsprint in India.

In 1992, India produced 14.33M tons of finished carbon steels and 1.59M tons of pig iron. In 2008, India produced

nearly 46.575M tons of finished steel and 4.393M tons of pig iron. In 1992, the total consumption of finished steel was 14.84M tons. In 2008, the total amount of domestic steel consumption was 43.925M tons. Today, India is in seventh position among all the crude steel producing countries.

The Indian IT industry is recognized the world over for its quality. Today, India leads the world in terms of the number of quality certifications achieved. Turnover will reach \$80B by 2011, growing at an annual rate of 30%/year as compared to a few million dollars in early 1990s.

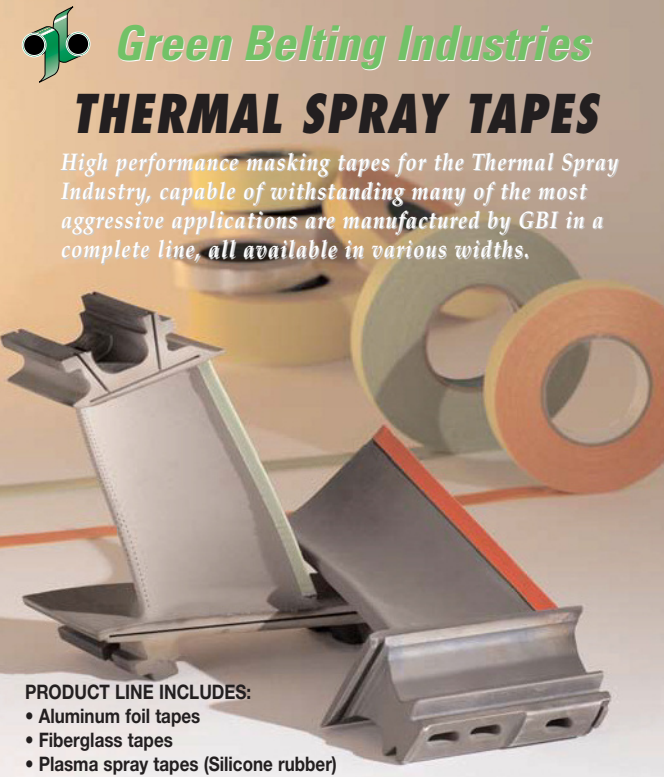
#### **Thermal Spray Companies and Research Centers**

The thermal spray community in India continues to expand through its coating shops, research centers and in-house dedicated coating and finishing operations. The following is an overview of the industry as well as select highlights from some of the thermal spray shops and research centers which we have been working with.

#### **Overview**

- Most coatings shops are privately owned with 2 to 5 spray booths
- Most are ISO 9001-2000 certified
- Spray equipment includes PTA, wire, plasma, detonation gun (ARCI developed), HVOF
- Interest in laser hardening, cold spray, nano-technology
- Piston ring manufacturers have in-house capability
- No regional or national thermal spray association exists

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- This industry imports much of its feedstock, wire, rod, equipment and spare parts. However there is an increasing amount of local production of equipment and feedstock for flame, HVOF and arc processes
- Interest in technology transfer, licensing, best practices.

#### **Plasma Spray Processors, Mumbai and Talaja "www.plasmaspray.net":**

- First thermal spray shop in India. Founded by Mr. Navin Doshi in 1984
- ISO 9001:2000 certified
- Arc spray, flame spray, plasma, HP/HVOF, HVOF, PTA, welding
- Robotics, machining, finishing
- Large parts up to 2.5 tons – 4.9 ft dia x 19.7 ft long (1.5 m x 6 m)
- Serves the aerospace, construction, marine, oil field, paper and pulp, power generation, petrochemical, wire drawing, pump, printing, and machine manufacturing industries.

#### **Plasmatron, Pvt LMT, Mumbai "www.plasmatronindia.com":**

- Founded in 1988
- ISO 9001:2000 certified
- Arc spray, welding, plasma, detonation gun, HVOF
- Grit blasting, ultrasonic cleaning, chemical cleaning
- Large part processing up to 20 tons – 4.9 ft dia x 16.4 ft long (1.5 m x 5 m)
- Machining, finishing, dynamic balancing.

#### **Associated Thermal Spray, Kathwada "www.thermalsprayindia.com":**

- Co-founded in 1992 by Bhavesh Oza and Jayesh Patel
- ISO 9001:2000 certified
- HP/HVOF, HVOF, plasma, arc spray and flame spray
- Large part capability in state-of-the-art booth – 45.9 ft x 13.1 ft x 13.1 ft (14 m x 4 m x 4 m)
- Machining, grinding, dynamic balancing
- Manufacture, coating, finishing of such parts as rolls, valves, plungers
- On-site capability
- Collaboration with Tocalo Co. Ltd. Japan.

#### **Sai Surface Coating Technologies (SSCT), Hyderabad "http://saicoatings.com":**

- Founded in 2000
- Consortium of 3 companies: SSCT, S.M.S. Coatings Pvt. Ltd Hyderabad, SVX Powder M Surface Engineering



**A 2008 Indian Premier League Twenty20 cricket match being played between the Chennai Super Kings and Kolkata Knight Riders.**

- Pvt. Ltd, New Delhi
- ISO 9001:2000 certified
- Detonation gun and Micro Arc Oxidation licensee from ARCI
- Plasma, flame spray, arc spray, PTA, GTA (TIG) welding
- Machining and finishing capability
- Serves the aerospace, steel, paper, textile, medical, power industries.

#### **BHEL Centre of Excellence in Surface Coatings, "Hyderabad www.bhel.com":**

- Operational since March 2007
- Plasma, D-Gun, HVOF
- Laser hardening
- Automation and robotics
- Collaboration with domestic and foreign universities
- Focus on steam turbine, power generation, industrial, space.

#### **ARCI – International Advanced Research Centre for Powder Metallurgy and New Materials, Hyderabad "www.arci.res.in",**

founded in 1985, is an autonomous R&D Centre of Government of India's Department of Science and Technology (DST). ARCI has been setup with a mission to develop unique, novel and techno-commercially viable technologies in the area of advanced materials and subsequently transfer them to Indian industries:

- Detonation Spray Coating (DSC) Technology  
The DSC technology has already been transferred to four private enterprises, namely Shafel Tech, Sai Surface Coating Technologies, Associated Plasmatron and SVX Powder M Surface Eng Pvt. Ltd.
- Micro Arc Oxidation (MAO)  
The MAO technology is a novel means of depositing dense, thick and ultra-hard coatings on metals like aluminum, magnesium and zirconium and their alloys. On the strength of its innovative features, the technology has been patented both in India and in the US and its promise to replace conventional coating techniques like hard-anodizing, hard-chrome plating, etc. has also been demonstrated.

#### **Recent News**

There have been a number of recent developments between the government and industry in India with its counterparts globally. The following are some select highlights that will positively affect business opportunities in India.

**CHICAGO, Feb. 14, 2008 -- The Boeing Company and Tata Industries Limited of India** have agreed on a plan to form a joint-venture company that will initially include more than \$500M of defense-related aerospace component work in India for export to Boeing and its international customers. It is the intent of Boeing and Tata not only to utilize existing Tata manufacturing capability, but also to develop new supply sources throughout the Indian manufacturing and engineering communities for both commercial and defense applications.

**Congress approves U.S.-India nuclear deal (excerpt from the LA Times, October 2, 2008)** "... After three years of negotiation, Congress gave final approval Wednesday to a U.S.-India nuclear agreement that its

advocates say will form a lasting strategic alliance between the United States and the world's largest democracy...The agreement, which the Bush administration considers a significant foreign policy achievement, would end a 30-year ban on sales of nuclear fuel and technology that was imposed after India tested and developed a nuclear bomb..."

**GE signs nuclear reactor agreement with India (excerpt from a Business Week article March 23, 2009)** "...A unit of General Electric Co. said ... it signed preliminary agreements with two government-owned companies in India to build nuclear reactors to help meet India's energy production goals. The potential value of the deals was not disclosed.

GE Hitachi Nuclear Energy said it signed memoranda of understanding with Mumbai-based Nuclear Power Corp. of India, the country's lone nuclear utility operating 17 reactors, and Bharat Heavy Electricals Ltd., a New Delhi-based manufacturer and supplier of power generation equipment and components..."

**Excerpt from "The Hindu" (India's largest national newspaper) March 25, 2009** "... India calls for renewable energy partnership with U.S. Washington (IANS): India has suggested a strategic partnership between Indian and U.S. business focusing on three R's - renewables, reusables and recyclables - to meet the twin challenges of climate change action and energy security.

"If energy is not to become a constraint on our growth — the growth of India and the U.S. and the global economy as a whole, then a relatively rapid and significant shift to renewable and non-conventional energy sources becomes inevitable," Shyam Saran, Prime Minister Manmohan Singh's Special Envoy for Climate Change, said here on Tuesday.

"Both climate change action and energy security dictate this," he said addressing members of the U.S. India Business Council, a trade association representing 300 of the largest U.S. companies investing in India and global Indian companies. Even as he was speaking, a U.S. trade mission was in India to discuss business opportunities in the field of solar energy. This was the Obama administration's first trade mission to India..."

#### Conclusions

##### Why India?

- Largest democracy in the world
- English is the language of business
- Growing middle class
- Large, skilled, young work force
- Premier country for graduating metallurgists, and material scientists
- Growing automotive and aerospace markets including ancillary services
- Foreign Direct Investments (FDI) is encouraged and welcomed
- Joint ventures and technology transfers are desired
- Regulatory, legal and taxation overhaul is ongoing.

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Mr. Chris Runckel, President, Runckel & Associates for his permission to use data and graphics on India and its automotive, steel, pulp and paper and IT sectors from his company's website "www.business-in-asia.com".

##### About the Author

Ms. Mozolic has over 30 years experience in the thermal spray industry having been employed by Praxair, Sulzer-Metco and H.C. Starck. In 2006 she founded The Mozolic Consulting Group, LLC focused on surface technology and powder metallurgy solutions for industry. With her partner Mr. Raghunath, founder and principal of INTAG, Mumbai, they are developing commercial and technical relationships between companies in North America and companies in India. Ms. Mozolic holds a BS and MS in materials science from MIT.

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## Metallisation Equipment and J Kirkaldy LTD Key to Refurbishment of Cornish Swing Bridge



The historical Ross Swing Bridge by the Isles of Scilly ferry port on Penzance sea front is currently undergoing a major refurbishment to improve its appearance, reliability and reduce the costs of future disruption and maintenance. The works are being carried out by Cornwall County Council's contractor Cormac and part of the refurbishment includes the thermal spraying of the bridge with aluminium to protect it from corrosion.

Metallisation's customer, J Kirkaldy Limited, a preservation and coating specialist, has won the competitive contract to protect the bridge from corrosion, using Metallisation's MK73 flame spray equipment and its years of experience in corrosion protection.

The original swing bridge was built in 1881 from an old railway turntable to give access to the Abbey Basin and dry dock. This bridge was replaced in 1980, constructed by local Cornish company Visick's Foundry. The new bridge was painted with a multi-coat paint system, which over the years has broken down resulting in significant visible corrosion, which if left, would result in potential structural damage. The total refurbishment of the bridge will take about 12 weeks to complete and will include the renewal of the hydraulic actuating mechanism, repair and repainting of the steel structure and the replacement of the timber bridge deck.

The bridge, which opens to allow boats into the dry dock approximately 20 times per year, is not only subjected to the harsh sea environment it's located in, but also the wear and tear of the traffic it carries into the Penzance seafront and harbour areas.

In 2008, while the Planning Transport and Estates Department considered how to protect the bridge long term, Cornwall County Council consulted with Metallisation and Thermal Spraying and Surface Engineering Association, UK (TSSEA). The aim of the discussion was to explore and evaluate thermal spraying as an option to protect the bridge from corrosion, instead of a standard paint system.

Scott Perry, Civil Engineer, Cornwall County Council, says: "Following consultation with Metallisation and TSSEA and

considerable research into corrosion protection, we opted for the Highways Agency specification for thermal spraying due to its proven durability and long term corrosion protection. We were also very impressed with Metallisation and J Kirkaldy, as both companies inspired confidence and were extremely knowledgeable during our discussions. This was reassuring for us, as it's our first experience of using thermal spray as corrosion protection for refurbishment."

The option to use thermal spray is not only promoted within the industry but is also backed up by its inclusion in independent International Standards (EN ISO 14713), as a system to provide unrivalled corrosion protection in a number of environments. This is why it appears in specifications for key civil and marine applications, as the Highways Agency and Network Rail coating specifications, as well as many offshore oil industry companies.

Before work could start on the major overhaul, the bridge was lifted 3.3 ft (1 m) off the ground to allow access to all areas. The turning mechanism was then dismantled and sent away for refurbishment. Once the wooden deck was removed, which will be replaced by a lightweight aggregate concrete deck weighing the same as the timber deck, the steel structure was covered with a large industrial shrink wrap enclosure, under which all of the thermal spraying took place. Hampshire based, SCA Group, specialists in contract scaffolding and shrink wrap containment, was appointed to erect a large scaffold structure over the bridge, which was then shrink wrapped, using heat guns, to create the perfect atmospheric conditions for thermal spraying. The enclosure was then fitted with an extraction system, dehumidifiers and heaters to create the optimum environment for surface preparation, thermal spraying and painting of the bridge. The shrink wrapped enclosure also ensured that dust generated during the surface preparation and coating process was contained and didn't contaminate the local environment.

To meet the recommended Highways Agency specifications, surfaces were first grit blasted to SA 3 cleanliness, using garnet, and then sprayed with 3.9 mil (100 µm) minimum of aluminium using Metallisation's MK73 flame spray system. A single coat of epoxy sealer was then applied at a spreading rate of 160-215 ft<sup>2</sup> (15-20 m<sup>2</sup>) per liter to seal the aluminium thermal spray the same day,



Spraying within the enclosure.

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**Spraying within the enclosure.**

followed by three coats of paint. The inclusion of an aluminium coating should guarantee a protective, maintenance free surface well in excess of 20 years, which is important considering the harsh environment the bridge is located.

The bridge steel frame is 22.3 ft wide x 90.2 ft long x 2.25 ft high (6.8m x 27.5m x 686mm). In total 6,750 ft<sup>2</sup> (627m<sup>2</sup>) of steel structure has been thermal sprayed including barriers and handrails. Over time the refurbished bridge will require some cosmetic enhancements to the paint system, but this compared to the previous high level, full maintenance; will mean the bridge is closed for less time, which will result in less disruption for local traffic and businesses during the important tourist season. This will also see a significant reduction in maintenance costs.

#### **The Metallisation Flame Spray Process**

In the wire flame spray process, mainly used for anticorrosion coatings, a wire is fed by a driven roller system through the center of an oxygen-propane flame where it is melted. An annular air nozzle then applies a jet of high-pressure air, which atomizes and projects the molten material onto the work piece. The driving of the wire is typically via an air motor and gearbox that form part of the gun. Wire is typically dispensed from coils or production packs (drums). Major advantages of the flame spray process are that the coatings are available for almost instant use with no drying or curing times. There is very minimal heat transferred to the component being sprayed so damage from distortion, which can be seen with galvanizing of thin structures, is not experienced. As the coatings are actual metals (typically pure aluminium or zinc for corrosion protection), they are very durable and hard wearing compared to many paint systems.

Dave Figgins, Managing Director of J Kirkaldy Limited, says: "Thermal spraying the Ross Swing Bridge was the most obvious solution as far as we were concerned. It has been proven time and again

that it provides excellent, long-term protection against corrosion, particularly for large, exposed steel structures. We are also very proud that we have managed to undertake a project such as this in the heart of winter 2009, one of the coldest we have had for many years. This is a huge advantage of the Metallisation Flame Spray process, as there is no drying or curing time needed. Due to the importance of completing this job on time, we have just ordered another MK73 gun from Metallisation to ensure we can meet the strict deadlines and ensure no further disruption is caused to the local community."



**Bridge (enclosed) seen from the water.**

Established in the UK in 1922, Metallisation is synonymous with thermal spraying to a diverse range of industries around the world. Metal 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 anti-corrosion and engineering coatings. Working with a company such as J Kirkaldy Limited, that is a member of a thermal spray association, has achieved ISO 9001/2008 Certification for blasting up to SA3 standard and for the application of thermal spraying, lets companies know that we are fully qualified in all aspects of corrosion protection.

**For more information** on Metallisation, please call Stuart Milton, Sales and Marketing Manager, on 01384 252 464 or visit [www.metallisation.com](http://www.metallisation.com).



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## New Dust and Fume Collector Delivers High Performance For Small Airflow Applications

Farr Air Pollution Control has introduced a new Gold Series® GS4M Mini dust collector that controls emissions from small airflow applications up to 2,000 cfm. It incorporates the best features of Farr's premium Gold Series cartridge collectors — rugged construction, durability, high filtration efficiency and ease of service — into a compact and competitively priced unit ideal for capture of dust and fumes from laser cutting tables, welding stations and many other small airflow processes in the full range of manufacturing industries. The collector's extremely quiet performance and small footprint make it ideal for indoor applications, especially where noise and/or space constraints are a concern.

The collector is a fully assembled and pre-wired unit complete with a low-noise fan (<70dB), controls, motor starter, filters and cleaning system.

It contains four HemiPleat® flame retardant filter cartridges with 788 total ft² of media rated at 99.99%



**Gold Series® GS4M  
Mini dust collector.**

efficiency on 0.5 micron particles (MERV 12). HemiPleat technology has won multiple industry awards for its innovative "open-pleat" design that delivers longer cartridge service life at reduced pressure drop. The automatic, reverse pulse cleaning system is activated by an on-demand control panel that ensures more efficient cleaning and optimizes cartridge life. A safety monitoring filter is also included to allow recirculation of the filtered air downstream of the collector for energy savings.

The Gold Series GS4M collector uses a 3 horsepower fan motor designed to handle 1,000 cfm at 9 in. w.c. or 2,000 cfm at 5 in. w.c. static pressure. The footprint of the collector is approximately 38 in. square with a height of less than 8 ft. Maintenance features include a spark trap inlet for fire prevention, easy-to-remove aluminum dust drawers, and a cam-lock system that allows fast and easy cartridge removal with no tools required. An optional explosion vent is available for combustible dust applications. Different filter media, inlet configurations, a dust hopper and leg support structure, aluminum and stainless steel flex ducts, and a spark-resistant flex hose are among the many other available options.

**For further information**, contact Farr APC via email [filterman@farrapc.com](mailto:filterman@farrapc.com); phone 800.479.6801; fax 800.222.6891; or write to Farr APC, 3505 S. Airport Road, Jonesboro, AR 72401; web [www.farrapc.com](http://www.farrapc.com)

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### Wall Colmonoy Aerobrazo, Cincinnati Achieves Nadcap

Wall Colmonoy Corporation Aerobrazo Cincinnati achieved Nadcap re-accreditation for welding, brazing/heat treat, coatings, chemical processing and NDT. These certifications demonstrate the continued commitment to the highest standards in quality and operational practices for Wall Colmonoy Aerobrazo.

"Our focus is continuous improvement and customer satisfaction. Our strengths are continual improvement, preventive action and corrective action" said Chris Palser, quality manager for Wall Colmonoy Corporation. "We are prided in having these special process approvals as our business model, making us a one-stop process facility to meet our customer needs."

Since 1955, Aerobrazo has been providing quality service to customers in aerospace and commercial industries as a manufacturer of aircraft-engine components. Now owned by Wall Colmonoy Corporation, they are a licensed FAA repair station and continue to serve the aerospace industry, as well as commercial and military customers that require complete product manufacturing.

**For further information** on Wall Colmonoy Aerobrazo, visit: <http://www.wallcolmonoy.com/locations/cinci.html>



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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 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](mailto:t.wilmert@fstincusa.com) or visit website [www.fst.nl](http://www.fst.nl)

## Thermal Spray Depot and Bug-0 Systems

### Introduce SprayBug™

thermal spray depot

Thermal Spray Depot and Bug-0

Systems have teamed up to introduce a cost-effective, automated solution for the thermal spray industry.

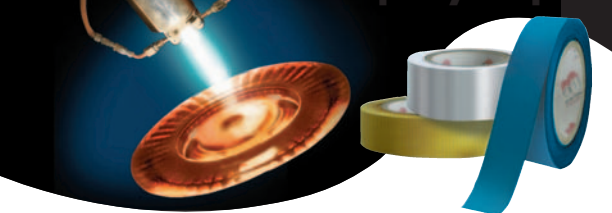
Job shops have always had the challenge of the time (and money) required to set up equipment to spray one part. Hand spraying is much faster for set up; but has become less desirable because of safety issues and the concern over consistency of coatings. Job shops have been asking for simple automation that is cost-effective, one-axis, mobile, and simple-to-use. They want to be able to quickly set up and spray various length and diameter shafts with a reproducible, consistent coating.



Thermal Spray Depot has listened to their customers and worked with Bug-0 Systems to create the SprayBug™. It is manufactured from stock components available from Bug-0 Systems that have been adapted specifically for thermal spray job shops.

The standard SprayBug™ has 54 in. of travel on a 96 in. beam that is mounted on posts with casters and floor locks. The 24 in. carriage comes with a gun mount that has 5 axes of manual adjustment. The eight ball bearings and double track on the carriage create an extremely stable platform for combustion, arc, plasma, and HVOF systems. The length of travel is adjusted in seconds with micro switch technology. Additional four ft and eight ft beam and post extensions can be bolted on the standard SprayBug to create any length traverse that is needed.

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DeWAL Industries offers the highest quality, most complete line of thermal spray tapes — aluminum foil, fiberglass fabric, silicone-impregnated fiberglass, and combinations of these materials.

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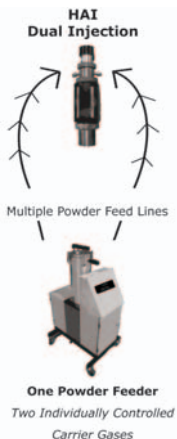
*For a video of the SprayBug™ in action* and more information, please go to [www.spraybug.com](http://www.spraybug.com).

Thermal Spray Depot was founded by Robert McDemus to service the thermal spray industry through strategic alliances and partnerships with companies outstanding in the industry. The combination of Bob's 30 years of experience, graduate degree in material science, and strategic alliances delivers cost-effective solutions for coating shops.

*For more information*, please visit the Thermal Spray Depot website [www.thermal-spray-depot.com](http://www.thermal-spray-depot.com)

### HAI Introduces a New Powder Feeder for Dual Injection HVOF Systems

HAI Advanced Material Specialists, Inc. in Placentia, California, had recently introduced a new Dual Feed Powder Feeder, Model HA 5171P-D. It is a sophisticated yet durable and rugged dual feeding unit specifically designed for heavy duty production feeding for all thermal spray applications.



The powder is fed through two independent powder lines from one powder canister, with each powder line being controlled separately for optimized powder injection within the gun. This feature is especially useful when dual feeding is required without the added investment for a second powder feeder. The design and construction of this feeder has proven to offer greater dependability with unparalleled accuracy and consistent flow of powder to the thermal spray gun.

The control panel features a large digital display for easy programming and viewing of certain critical information; e.g., electronic canister pressure sensing, spraying time display, and powder feed rate. The powder canister has been designed to tilt 180° allowing the operator fast, easy powder change outs.

The HA 5171P-D is the powder feeding unit that is designed and built for today's sophisticated thermal spray demands; utilizing a built-in load cell, powder consumption and feed rate control is only a matter of a push-button input, thereby eliminating the time consuming and painstaking task of performing countless powder feeder "catch can" tests.

Additionally, the powder feeder carrier gas control unit

maintains the powder canister at operating pressures even while the powder feed is shut off. The powder saving instant powder feed Start/Stop along with built-in selectable vibration capability mounted on a durable cart for easy transportation and relocation are a few more of these features that make this feeder one of the most advanced powder feeders on the market today.

Design features include:

- OIT PLC feed rate control in RPM or g/min
- Single or dual feeding capability
- Single or dual carrier gas supply
- Large PLC display for easy set-up and programming
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- Electronic canister pressure sensing
- Built-in selectable vibration
- Carrier gas by-pass
- Instant powder feed start/stop, less powder waste
- Large canister volume, 2 gal (7,500 cm<sup>3</sup>) for long production runs without refill
- Audible and visible low powder level alarm
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- Designed for LPPS and VPS usage (vacuum capability).

*For more information*, contact worldwide service call: 714-414-0575 toll free in USA and Canada: 877-411-8971, website: [www.haiams.com](http://www.haiams.com), 1688 Sierra Madre Circle, Placentia, CA 92870



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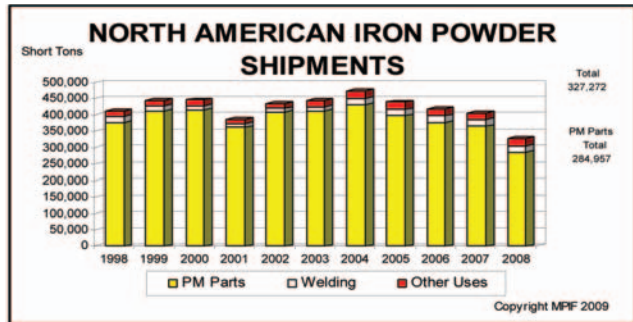
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## Metal Powder Industry Surviving Recession

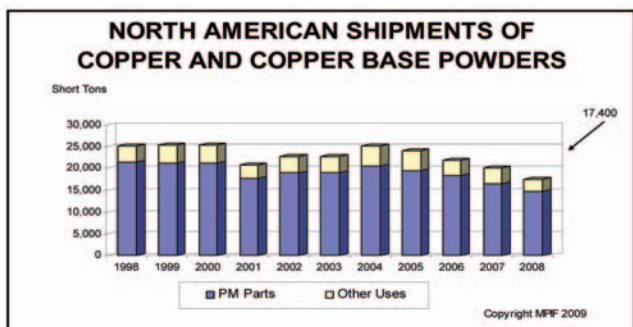
"We can view the current state of the powder metallurgy (PM) industry through short-term fear-tinted glasses or as long-range opportunities," reported Mark C. Paullin, president of the Metal Powder Industries Federation (MPIF) here during the PowderMet2009 Conference. "Just like U.S. manufacturing in general, the PM industry has been impacted negatively by the current recession and plunging automotive production."



Beginning on a hopeful note, the PM industry in 2008 weakened in the second half, especially in the final quarter mainly due to a sharp decrease in auto production in November and December. Iron powder production declined 19% to 327,272 short tons, copper and copper-based powder shipments declined 13% to 17,400 short tons, and stainless steel powder shipments declined about 20% to an estimated 7,750 short tons.

Reflecting the continuing decrease in auto production, metal powder production declined further during the first half of 2009.

Paullin stressed that the PM industry still has much to offer car makers in conventional power trains, in diesel engines, and in hybrid vehicles. "We can offer innovative engineering/materials solutions, cost savings, and a technology that is environmentally safe." Future PM parts usage in light vehicles is projected to grow from between 590,000 to 900,000 tons globally by 2015, based on an estimated global market of almost 77 million vehicles. Potential new applications include connecting rods for diesel engines and electric traction drives and electric motor gears in hybrid vehicles.



Paullin reported that the MPIF Technical Board had just released the results of the PM Parts Catalog study that has identified more than 300 PM automotive applications representing more than 750 total parts.

Renewable "green" energy, particularly in wind turbines

and solar panels, presents opportunities for conventional PM, metal injection molding, and nanotechnology. PM is a sustainable, net-shape manufacturing process that has long been recognized as a green technology for minimizing energy consumption and for recyclability.

### North American Metal Powder Shipments

	2007	2008
Iron & Steel	404,650	327,272
Stainless Steel	9,676 (E)	7,750 (E)
Copper & Copper Base	19,992	17,400
Aluminum	50,000 (E)	42,500 (E)
Molybdenum	2,800 (E)	2,000 (E)
Tungsten	4,650 (E)	4,000 (F)
Tungsten Carbide	7,394	5,103
Nickel	9,190 (E)	8,650 (E)
Tin	785	752
(E) estimate	509,137 short tons	415,427 short tons

Although still in their infancy, rapid prototyping and rapid manufacturing offer exciting opportunities for PM as well, Paullin reported.

"While the PM industry faces many challenges, it will still be an important materials technology and manufacturing process," Paullin concluded. "As the current recession subsides, the PM market will return and grow. The U.S. automotive and industrial markets will still need innovative suppliers that offer precision productions and cost savings."

*For more information*, visit website [www.mpif.org](http://www.mpif.org)



UtahStateUniversity

### Coanda-Assisted Spray Manipulation for Vectoring High Speed Plumes

By Glenn Whichard, Katie Mabey, and Barton Smith,  
Utah State University

There are many processes that can benefit from the ability to precisely vector a jet, or plume, and control the jet geometry. These include coating processes, such as flame spray and plasma spray, in which it is vitally important that the coating thickness be uniform, even in regions where it is difficult to maintain a constant standoff distance and optimal angle of incidence. In addition, the contents of the jet, or effluent, can be combusting or can contain a plasma, thus making the environment in which the jet operates very hostile from both a chemical and temperature perspective. The nozzles of modern thermal spray devices are designed for the desired process and are generally not directional. Due to the high temperature combustion environment present in or near the process nozzles, mechanical vectoring of the nozzle is not feasible since this would place moving parts in the jet flow, reduce device durability, and severely limit directional frequency response. Control schemes that rely on aiming the nozzle

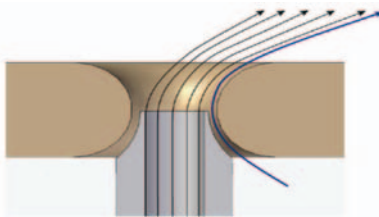


while maintaining the orientation of the gun body would require moving parts in the hostile environment resulting in decreased device performance and coating quality.

Utah State University researchers have invented a device that uses a flow-control methodology to vector and adjust the geometric profile of high-speed jets or plumes without moving parts. The device is based on the Coanda effect, also known as "boundary-layer attachment", and is the tendency for a stream of fluid to remain in contact with, or attached to, a convex surface rather than following a straight path in its original direction. This patent pending Coanda-assisted Spray Manipulation (CSM) device makes it possible to precisely control the deposition location to enhance coating thickness control with a single nozzle and no moving parts in or near the jet flow. The CSM technology enables long-term operation of controllable jets or sprays in harsh, corrosive, high temperature, and combusting environments.

The Coanda effect results from reduced pressure on the inside of the turning radius. This competes with the dissipation of the boundary-layer energy until the flow detaches from the surface. The Coanda effect is often bi-stable, meaning the flow may be completely attached or completely separated depending on the initial conditions, or even unstable, resulting in undesirable flapping of the flow. Boundary-layer separation, such as the separation of the fluid from the surface is suppressed by blowing a secondary or control flow through a slot or orifice in line with the primary flow. Flow-control is achieved by adding a blowing control flow to enhance the profile and direction

control, and improve the stability of the jet or spray. By blowing a control flow in the region where the jet meets the Coanda surface, the Coanda effect can be controlled and enhanced. The addition of the control flow makes it possible to turn the primary flow over a much smaller radius compared to the same flow conditions without the control flow. The change in direction of the control flow induces the primary flow to also follow the same pattern as the control flow. The surface contour acts to define how the control flow is going to pull the primary flow. In addition to the contour of the Coanda surface, the degree of blowing velocity of the control flow is controlled to manipulate the direction and profile of the resulting primary flow.



**Figure 1. Schematic showing the primary flow (black arrows) being vectored to the right by the control flow (blue arrows) on the Coanda surface.**

fied cross section of a nozzle. The primary jet flow (black arrows) passes through the center of the nozzle. A secondary or control flow (blue arrow) is introduced through one or more ports positioned circumferentially around the primary flow. Under the appropriate conditions, the control flow attaches to the Coanda surface of the nozzle and pulls the primary flow in that direction. The primary flow can be a high speed fluid, such as a gas or liquid, and in thermal spray applications it is the effluent exiting the nozzle.

The Utah State University Coanda-assisted Spray Manipulation technology employs numerous control flow

The Coanda effect is illustrated in Figure 1 which shows a simplified cross section of a nozzle.

continued on page 20

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continued from page 15

ports positioned circumferentially around the primary flow or thermal spray plume. An illustration of this device is shown in Figure 2. The flow through each control port is turned on or off individually by a set of valves, thus the circumferential position of the control flow can be adjusted by opening and closing one or more valves.

Figures 3a and 3b show the effluent from a flame spray gun equipped with an experimental CSM attachment. In Figure 3a there is no control flow and the effluent exits the gun along its axis. Figure 3b shows the effluent vectored upwards when a control flow is introduced at a circumferential position along the Coanda surface. The direction of the plume is changed by controlling the gas flows; there are no moving parts.

The design of the CSM system, with multiple control flow ports around the circumference of the primary jet, allows for almost limitless vectoring and profile control of the thermal spray plume. By closing one control port and opening another control port in a different circumferential location, the direction of the primary jet can be changed. This ability to vector the effluent allows for coating deposition in regions that are difficult to reach using existing equipment. The CSM system can enhance robot manipulation of the thermal spray device for coating parts with complex geometries by utilizing the ability to vector the effluent to achieve the desired deposition angle.

A precessing plume can be obtained by sequentially opening and closing control flow ports around the circumference.



**Figure 2. The circumferential position of the control flow can be adjusted to provide vectoring in various directions and a range of plume configurations.**



**Figure 3a. The effluent from a flame spray gun exits straight through the CSM device in the absence of a control flow.**



**Figure 3b. The effluent from a flame spray gun through the CSM device with a control flow on the top results in vectoring of the plume towards the control flow.**

This sequence of opening and closing the next control flow port in sequence around the circumference of the primary jet causes the plume to vector and rotate. By simultaneously opening control flow ports on opposite sides of the plume, the plume can be spread or elongated. The spread plume can be rotated by sequentially opening and closing opposite control flow ports around the circumference.

Other types of plume motion can be controlled by the CSM system. For example, rather than having the control flow ports open sequentially completely around the circumference, a side to side or back and forth plume motion can be obtained by sequentially opening and closing the control ports circumferentially to a specific location and then reversing the sequence. This creates a back and forth or wiping motion of the vectored jet.

Another application of the CSM technology in thermal spray coating deposition processes is the ability to control the residence time of the particles in the effluent. This is accomplished by managing the velocity of the effluent, the velocity of the control flow, the rate of precession of the control flow, and the particle size. The ability to manage the particle residence time, as shown in Figure 4 (page 17), provides a method for depositing coating with desired porosity or other microstructural features.

In cases where substrate heating is an issue, the CSM technology can be employed to rapidly precess or orbit the plume at rates above the response time

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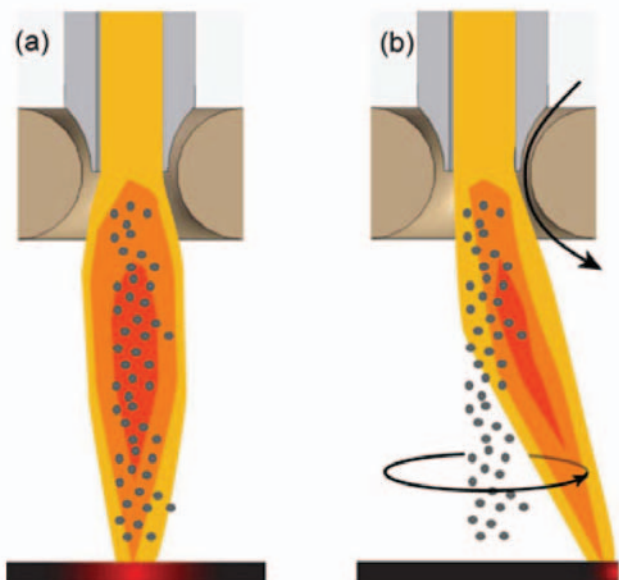


Figure 4a. Without vectoring the particles remain within the plume. Figure 4b. With the appropriate particle size and velocity, and plume precession rate, the particle residence time can be controlled.

of the particulate material. By orbiting the plume the intense heating of the substrate that is typical of thermal spray processes is mitigated. The heat is spread to a much larger area resulting in lower temperatures as shown in Figure 5.

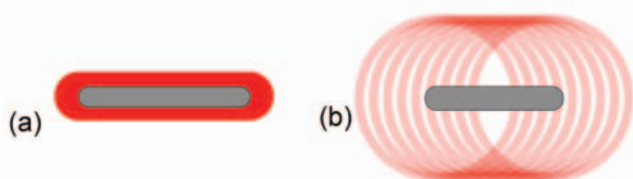


Figure 5a. A representation of substrate heating showing intense heat buildup as a thermal spray gun is traversed across a substrate.

Figure 5b. A representation of substrate heating showing temperature mitigation resulting from precessing the plume using the CSM technology.

In summary, the patent pending Coanda-assisted Spray Manipulation technology, developed at Utah State University, is a unique flow control method that can be retrofitted to thermal spray equipment to vector the effluent. The CSM technology can be used in various ways to deposit coating in difficult to reach places, influence coating microstructure, and mitigate substrate heating.

**Information on the development of the technology** can be found at <http://www.efdl.usu.edu/> which is the website for Utah State University's Experimental Fluid Dynamics Laboratory.

**A video** showing vectoring tests and flame profiles can be found at website <http://tco.usu.edu/htm/licensing-opportunities/engineering/csm--coanda-assisted-spray-manipulation>.

**To contact the authors**, and for more information on surface engineering technology at Utah State, email [Glenn.Whichard@usu.edu](mailto:Glenn.Whichard@usu.edu)



The Old Main building on the Utah State University campus in Logan, UT contains classrooms and faculty and administrative offices.

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### *Journal of Thermal Spray Technology*<sup>®</sup>

A publication of the *ASM Thermal Spray Society*

**Abstract: A Universal Method for Representation of In-Flight Particle Characterization in Thermal Spray Processes**

**W. Zhang and S. Sampath**

The advent of user-friendly in-flight process diagnostic tools has significantly improved our understanding of thermal spray processes. This paper examines the critical attributes of these diagnostic measurements and the applicability of the nondimensional group parameters as a mapping strategy for data visualization. Specifically, first-order process maps (process-particle interactions) have been addressed by converting the temperature (T)-velocity (V) of particles obtained via diagnostics into nondimensional group parameters {Melting Index (MI)-Reynolds number (Re)}. This approach provides an improved description of the thermal and kinetic energy of particles and allows for cross comparison of diagnostic data within a given process for different materials, comparison of a single material across different thermal spray processes, and detailed assessment of the melting behavior through recourse to analysis of the distributions. An additional group parameter, Oxidation Index (OI), has been applied to relatively track the oxidation extent of metallic particles under different operating conditions.

**Read the entire article in the March 2009**

***Journal of Thermal Spray Technology*.**

**For more information**, visit

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**Chairman Hayden**

company representatives to better understand member benefits. A complete list of ITSA member companies and their representatives are at [www.thermalspray.org](http://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.*

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### **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](http://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](http://www.spraytime.org) and complete the short questionnaire.

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### **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, in every issue of **SPRAYTIME**, as well as in our free edition of "What



Is Thermal Spray?”. ITSA members also receive an additional 10% advertising discount in the SPRAYTIME newsletter. 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 our membership chairman Jim Ryan at james.ryan@hcstarck.com or visit the membership section of our [www.thermalspray.org](http://www.thermalspray.org) website.

### International Thermal Spray Association Welcomes New Member



**ArcMelt™ Company** has joined the International Thermal Spray Association.

ArcMelt™ Company, located near St. Louis, Missouri, is setting new standards in the development and production of multi-element alloys. Our many years of experience in material research have advanced us into a composite alloy approach to coatings. When deposited onto a surface, ArcMelt™ composite coatings form composite structures. ArcMelt™ can design a composite coating or weld which adapts to your specific environment, rather than fight against it.

ArcMelt™'s current product line offers an array of composite thermal spray coatings and weld overlays which result in unique structures and alloy chemistries found to be effective in the most severe industrial environments. Our products can help solve many critical corrosion and wear issues found in the power generation, refining, paper and pulp, mining, and many other industries.

**For more information**, contact ITSA company representative David Urevich, Vice President, ArcMelt Company, 4734 Earth City Expressway, Bridgeton, MO 63044 USA, email: [durevich@arcmelt.com](mailto:durevich@arcmelt.com), phone 314.801.6900, fax 314.298.9684, web [www.arcmelt.com](http://www.arcmelt.com)

### 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](http://www.thermalspray.org) to see our new look and valuable industry information.

### ITSA Announces “Supporting Societies” Membership Category

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

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](mailto:itsa@thermalspray.org)

### 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. The program is intended to introduce the process and its uses to new potential users with morning and afternoon sessions focusing on actual applications and new developments in thermal spray technology. It will include a half-day tutorial Sunday, November 15th sponsored by the International Thermal Spray Association on thermal spray fundamentals titled “What is Thermal Spray?”.

This premier event is truly one that anyone involved in the thermal spray and coatings community should plan to attend. Visit [www.fabtechexpo.com](http://www.fabtechexpo.com) to register.

The conference abstracts are listed as follows:

#### **An Overview of Thermal Spray Processes and Applications**

Richard Thorpe, Praxair Surface Technologies

Thermal spray processes have developed through the years from simple, unsophisticated devices used to spray a few pretty basic applications with common chemical compositions to ever more complex systems capable of applying highly-developed coatings with intricate matrixes. Beginning with simple wire and powder flame guns using a



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flammable gas and oxygen spraying low velocity flames, the technology has evolved to the advanced air plasma spray (APS) and high velocity – oxygen fuel (HVOF) systems capable of spraying at much higher temperatures and velocities with alloys and composite materials used in the aerospace industry. Thermal spray processes and their applications have come out of the black art era and have now moved into an enlightened era of science and practicality.

### ***Practical Understanding of Materials for Thermal Spray Applications***

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

Thermal spray technology has been used successfully for many years in various wear resistant applications. The technical success of an application is based not only on the correct thermal spray process and parameters, but on a clear understanding of the wear mechanism(s) associated with the application and the proper material selection. Based on this fundamental understanding, powders can be selected to meet specific application needs. This presentation will discuss various WC-Co(Cr) and WC-Co(Cr) self-fluxing alloy powders that are presently in the market place. Important characteristics related to powders for wear applications are: 1) primary carbide grain size, 2) overall powder particle size, 3) manufacturing process, 4) matrix chemistry, and 5) powder density. Low and high angle erosion, adhesive wear, abrasive wear and fretting are just a few of the types of wear mechanisms reviewed in order to help grow applications in industrial markets such as agricultural, paper and pulp, hydroelectric, and hard chrome alternatives.

### ***Comparison of Hardcoating Processes***

Daniel Hayden, Hayden Corp.

Originally authored for the oil and gas industry, this presentation discusses the physical application and performance differences between common atmospheric (non-vacuum or inert environment) hardcoating techniques, including thermal spray, spray and fuse, traditional welding, and laser/PTA applied overlays. The discussion focuses on basic economic factors influencing the selection of one technology over another and attempts to highlight the pros and cons of each technology. It is intended to present each hard-coating method as a suitable choice for a select set of coating needs, rather than promoting one technology as superior to all others. Specific factors addressed are application cost, physical effects of the coating process to the substrate, durability of the overlay, and accuracy of deposition. For the purposes of this new thermal spray conference, additional discussion of individual atmospheric thermal spray processes is also included.

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

J. Wilden, Berlin Institute of Technology, Berlin, Germany

In waste incineration plants the metallic components are subjected to conditions, which can induce to high temperature corrosion. This kind of deterioration is especially related to the presence of chlorides, generated

during the incineration of the waste.

Therefore, to protect metal parts inside the plant thermal spray coatings are in use. These coatings must be able to avoid the reaction of chlorine compounds and the metal surface. Typically for atmospheres containing chlorine at high temperature are Ni-based alloys. However, because of the high costs of these alloys, there is an aim to develop coatings with good corrosion resistance, but less expensive. There are indications that Fe-Cr-Si alloys are rather resistant in environments containing chlorine compounds at high temperatures.

Therefore, in this study, different compositions of Fe-Cr-Si alloys are evaluated as coating materials. The layers were applied using the arc spraying process, which is generally the most economic method to apply metal coatings. Nevertheless, also this method has to be adapted to obtain coatings with required corrosion resistance. In this work, the first results in terms of characterization of the arc sprayed coatings and their performance in corrosion tests are presented.

### ***Tungsten-Based Coatings to Enhance the Performance of Casting Molds***

J. Wilden, S.Jahn, V.E. Drescher

Berlin Institute of Technology, Berlin, Germany

Casting molds, especially in the aluminium industry, show a short lifespan, due to the high corrosiveness of molten metals and alternating thermal and mechanical loads. By using new materials, for example tungsten-based pseudoalloys, the lifetime of casting molds can be elongated up to a thousandfold. In spite of the advantages of these materials, high manufacturing cost and the increasing commodity price of tungsten prohibit the use of molds consisting of these progressive materials. By coating the standard steel molds with a layer of these materials the excellent thermal and corrosive resistance of the pseudoalloy surface can be combined with minimal manufacturing costs. In the present work steel substrates and real components of casting molds were coated with tungsten-based pseudoalloys. Different compositions and coatings processes were compared to produce the best performance of the coatings.

### ***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

Cold gas dynamic spray process is a high-rate material deposition process in which fine, solid powder particles are accelerated in a supersonic jet of compressed gas to impact the target substrate surface at velocities ranging from 1640-3280 ft/s (500-1000 m/sec). In this paper, a review of literature is made in respect to the coating deposition by cold spray process. The successful bonding of the powder particles on the impinging surface depends on number of parameters — gas parameter, powder properties,

***For more information and to register for the "New Developments in Thermal Spray Coatings, Processes and Applications" Conference, visit [www.fabtechexpo.com](http://www.fabtechexpo.com)***

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substrate properties, nozzle geometry, process parameters and spray conditions. The deposition of particles on the substrate takes place due to plastic deformation at the onset of adiabatic shear instability. The cold-sprayed coatings are uniform, dense, and hard and have good electrical and thermal conductivity due to which they provide cost-effective and environmental friendly technological applications.

### ***Practical Applications of Cold Gas-Dynamic Spray (Low Pressure Cold Spray)***

David W Wright, Accuwright Industries, Inc.

Accuwright Industries, Inc. is a leader in research & development and production applications of LP Cold Spray. Applying soft materials such as aluminum, copper, zinc and alloys of these materials, Accuwright has developed and pioneered repairs for aluminum and magnesium housings and worn components with aerospace and industrial applications. We propose to describe a brief history of our developments and specific application success to share practical potential in the Cold Spray process capabilities.

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

Julio Villafuerte, Centerline Windsor Ltd

Shockwave Induced Spraying (SISP) is a new solid-state spraying process that enables the deposition of dense metals, alloys, cermets and polymers on substrates at lower temperatures than what is typically used in traditional thermal spray processes and with high deposition efficiencies and rates. The properties of both the feedstock and the substrate remain unaffected throughout spraying. In thermal spray processes, such as high velocity oxygen fuel (HVOF) and plasma spraying, bonding is obtained by the combination of thermal and kinetic energy of the sprayed particles. In numerous applications, the thermal component, which typically melts the spray material, is sufficient to produce undesirable oxidation, porosity, metallurgical transformations and residual stresses. Similar to cold gas dynamic spraying (or cold spray), SISP can produce thick coatings onto a diversity of surfaces at reduced temperature, minimizing thermal effects such as oxidation, tensile residual stresses, and metallurgical transformations. It is understood that this novel process can be used to enhance surfaces for corrosion protection, thermal insulation, thermal dissipation, wear resistance, electrical conductivity, restoration, and other applications without the detrimental effects of elevated process temperatures. In this paper, we review the working principles as well as potential benefits of the novel SISP technology for a number of applications.

### ***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

Cobalt-containing carbide powders such as WC-Co and WC-Co-Cr for thermal spraying exist in numerous modifications varying in chemistry, carbide size, and production method. They are widely used for wear, erosion and corrosion protection in many industrial fields. However, for decades

it has been well known from the hard metal industry that WC and Co-containing hard metals in breathable dust form can provoke severe lung diseases if inhaled. Recent examinations have proven that this toxicity can be significantly reduced if the Co is pre-alloyed by Fe. In thermal spraying employees are also dealing with Co containing carbides, for example in powder and coating production.

Therefore, in order to reduce the hazards for health and environment, new agglomerated and sintered carbide powders using alternative matrix materials — such as Fe-Cr-Al and other Fe based alloys — have been developed and investigated. In the present study the powders were HVOF sprayed in order to examine the influence of their different composition and morphology on the microstructure and the properties of the coatings in comparison to standard materials. The experiments comprise microstructural examinations, wear and corrosion tests.

### ***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

Cold gas dynamic spray, the ground-breaking technology in the past decades in the field of thermal spray, is a solid state high kinetic energy coating and free-form technique. This technique has triggered major interest in the aerospace industry due to its potential to fabricate aerospace engine components with minimal material waste. Owing to the severe requirements in producing these components, cold sprayed coatings must prove themselves reliable to earn recognition and to sustain their place in the industry. Thus, in this study, the adhesion strength of cold sprayed titanium coatings using nitrogen as propelling gas was evaluated according to ASTM C-633-01 standard. A number of feedstock titanium powder size distributions were used. Different particle impact velocities were achieved by varying process conditions such as temperature and pressure. In addition, an assortment of substrates of different surface roughness and hardness were investigated including aluminum alloy, pure titanium, and steel. Furthermore, the coating properties were studied via scanning electron microscopy and microhardness testing.

### ***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

Atmospheric plasma spraying (APS) is one of the simple and economic processes. It can simplify and replace the conventional processes to obtain bronze/diamond composite coating in a single step. However, graphitization and oxidation of diamond in the high temperature plasma gas flow are the main drawbacks of the APS process. Hence,

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the diamond particle size was sharply decreased during flight in the APS gas flow field. Also, a high diamond fraction along with uniform diamond distribution could not be obtained without considering process parameters in relation with thermal properties. In this study, to reduce the graphitization and oxidation of diamond during flight in plasma gas flow field, nickel-coated ( $3\text{ }\mu\text{m}$  thickness) diamond particles were used. For comparison with the nickel-coated diamonds case, bare diamonds were also deposited with bronze on an aluminum substrate. The microstructure of the coating and the diamond size were observed and analyzed using a scanning electron microscope (SEM) and image analyzer. The results show that diamond size was retained with uniform distribution in the composite coating and the diamond fraction was also increased.

#### ***Dense Ceramic Coatings Produced by Slurry Axial Plasma Spraying***

Michael Molnar, Mettech

Dense ceramic coatings are required for emerging applications such as solid oxide fuel cells (SOFCs), plasma erosion resistant coatings, and new thermal barrier

coatings (TBCs), among others. These applications present significant challenges for traditional plasma spraying. Currently plasma spraying uses powders in the range of  $10\text{--}150\text{ }\mu\text{m}$ , and the coatings for common applications such as TBCs typically exhibit porosities in the range of 5-15%. Finer powders yield denser coatings with thinner lamellae splats when compared to traditionally sized thermal spray powders. However, feeding issues have prevented standard techniques from producing coatings using powders finer than  $10\text{ }\mu\text{m}$ . By suspending these fine powders in liquid and injecting the solid/liquid slurry into the plasma plume, a reliable fine particle spray delivery mechanism that produces highly dense coating structures can be obtained. This paper presents the approach by Mettech to enable dense coatings by using axial feed and a new liquid feed system. A robust slurry coating process was demonstrated by the production of dense coatings primarily for SOFC and plasma erosion resistance applications.

#### ***Cermet and Ceramic Coatings with Novel Thermal Spraying Methods***

Junya Kitamura, Kazuto Sato, Nobuaki Kato and Hiroaki Mizuno, Fujimi Incorporated

Thick coatings of WC cermet materials are widely applied by high velocity oxygen fuel spraying (HVOF) due to their excellent mechanical properties. However, the coatings are still inferior to the sintered bulk WC for toughness due to degradation of the feedstock powders, such as decarburiza-

continued on page 26



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tion of WC, oxidation and formation of a brittle metal binder by mixing of WC and Co. Novel spraying methods with lower flame temperature, such as cold spraying and warm spraying, are one of the candidates to overcome the problem. Recent studies on cold spraying and warm spraying (modified HVOF) are introduced for the WC-Co coatings in this presentation. Plasma spraying producing high temperature flame jet has been used for ceramic materials. Plasma sprayed ceramic coatings have problems mainly due to their low density (high porosity) that causes lower mechanical properties in general. Suspension plasma spraying (SPS), developed recently, is one of the techniques to attain dense coatings where a suspension with fine ceramic powders of less than 10 micron is fed into the plasma plume. Mechanical and functional properties of yttrium oxide coatings by the SPS are also introduced in this presentation.

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

Chris Power, Genie Products Inc

Taking advantage of vacuum plasma spray (VPS) technology for building safe and durable cartridges for high temperature experiments in space furnaces, NASA's Marshall Space Flight Center (MSFC) and Genie Products, Inc. have been translating this VPS technology to building robust, long life liquid rocket engines. A subscale 5K (5,000 lb thrust) VPS formed chamber with a functional gradient material (FGM) hot wall, has now experienced 220 hot firing tests in pristine condition with no blanching (surface pulverization) or cooling channel cracks experienced in standard liquid rocket engines in less than 30 of the same hot firing tests. Normally, the 5K thruster combustion chamber is first VPS formed with a functional gradient material (FGM) hot wall in one continuous VPS operation. Cooling channels, then cut on the outside of the combustion chamber, are filled with a ceramic filler, VPS over-sprayed as a closeout, and the filler material removed by etching with a dilute acid. In building and testing larger engines, required by NASA for consideration in the space program, the next step chosen was a 40K (40,000 lb thrust) engine. A 40K thruster designed as a calorimeter was chosen because it could be used for measuring temperatures simultaneously with other NASA propulsion testing. Cooling channels in normal combustion chambers run parallel to the combustion flow. However, cooling channels in calorimeters run circumferentially and must be closed out by first filling the channels with wax and electrodepositing the closeout material around the outside surface. The electrodeposition process can take up to 12 months to close out the cooling channels on the Space Shuttle main engine. Taking advantage of the VPS process, the cooling channels on the 40K chamber were filled with wax and electrodeposited for five days. The calorimeter combustion chamber was then heated to remove the wax,

VPS coated for several hours, and subsequently machined, ready for placing in a support jacket and hot fire testing.

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

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

As for cold spray processes, Shockwave Induced Spraying offers the ability to spray materials such as metals, alloys, cermets and polymers with high deposition efficiency and high deposition rate but with a lower gas consumption. The shockwave induced spraying is based on a succession of high pressure gas pulses that provide the required kinetic energy to particles to form coating. Like cold gas dynamic spraying or cold spray, this technology can produce thick coatings onto a diversity of surfaces at low temperature, avoiding thermal effects such as oxidation, tensile residual stresses, and metallurgical transformations.

In this paper, we present the results of materials and process evaluation for coatings of several materials deposited using this new technology. Coating properties are investigated using SEM, bond strength testing and mechanical testing. Particle velocity and substrate surface temperature are recorded using an optical diagnostics system and ultrafast infrared thermograph, respectively. Deposition efficiencies and critical velocities are determined for all materials and process conditions. The results are compared with typical results obtained with commercial cold spray systems.

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

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

High-velocity oxygen fuel (HVOF) hardfacing of metallic work parts with WC-Co-type coating offers a performance and cost alternative to toxic chromium (Cr6+) plating. The cost competitiveness of HVOF hardfacing is, nevertheless, a strong function of production rate and deposition efficiency (DE) of feed powder. These are limited by significant heat input into substrate parts taking place during continuous HVOF coating which necessitates the use of forced air or gas cooling, frequently combined with additional cooling breaks in spraying. Thus, determination of the effect of cooling method on production rate and DE is industrially critical. Prior experiments with nitrogen cryo-aerosol cooling of landing gear during HVOF hardfacing using DJ2600 gun and SM5847 powder have demonstrated doubling of production rates and halving of powder consumption, as compared to those of the conventional air cooling, while depositing improved, less residually-stressed WC-10Co-4Cr coatings at increased DE. Present work compares effects of three different cooling methods on DE and substrate temperature during nonstop HVOF coating using JetKote-II Nova gun and JK120H powder: (1) forced air, (2) liquid CO<sub>2</sub>, and (3) N<sub>2</sub> cryo-aerosol. It is found that the air cooling DE of 45%, measured per ISO 17836/2004, is increased to 48% with liquid CO<sub>2</sub> and to 54% with N<sub>2</sub> cryo-aerosol. Experimental results will be detailed and explained by the combination of oxidizing potential of cooling gases used and the average substrate temperature during coating.

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## CALENDAR OF EVENTS

## AUGUST 2009

**25-29 Berlin, Germany** *Thermec 2009 Int'l Conference on Processing & Manufacturing of Advanced Materials* - visit [www.thermec.uow.edu.au](http://www.thermec.uow.edu.au)

## SEPTEMBER 2009

**7-9 Bremen, Germany** *4th Int'l Conference on Spray Deposition and Melt Atomization SDMA 2009 and 7th Int'l Conference on Spray Forming ICSF VII* - email [sdma2009@iwt.uni-bremen.de](mailto:sdma2009@iwt.uni-bremen.de)

**13-15 Waikoloa, HI USA** *Int'l Titanium 2009* - tel: 303.404.2221, email: [ita@titanium.org](mailto:ita@titanium.org), web: [www.titanium.org](http://www.titanium.org)

**14-19 Essen, Germany** *International Trade Fair - Joining, Cutting, and Surfacing* - visit web: [www.messe-essen.de](http://www.messe-essen.de), contact email: [christina.kleinpass@messe-essen.de](mailto:christina.kleinpass@messe-essen.de)

**30 SEP-1 OCT Baltimore, MD USA** *Aero & Defense Test 09/ITEA Annual Symposium* - contact Ian Stone, email [ian.stone@aerotestamerica.com](mailto:ian.stone@aerotestamerica.com), [www.aerodefensetest.com](http://www.aerodefensetest.com)

## OCTOBER 2009

**5-8 Bethesda, MD USA** *World Standards Week sponsored by American National Standards Institute (ANSI)* - contact 212.642.4956, web: [www.ansi.org](http://www.ansi.org)

**6- Rosemont, IL USA** *SAE Commercial Vehicle Engineering Congress & Expo* - contact Nancy Lewis tel: 248.273.4092, email [pr@sae.org](mailto:pr@sae.org), web: [www.sae.org](http://www.sae.org)

**19-22 Toronto, Ontario Canada** *Canadian Manufacturing Technology Show 2009* - visit [www.sme.org](http://www.sme.org)

**20-23 Munich, Germany** *Ceramitec, 11th Int'l Trade Fair for Machinery, Equipment, Plant, Processes and Raw Materials for Ceramics and Powder Metallurgy* - tel: +49.89.9.49.1.1378, email: [info@ceramitec.de](mailto:info@ceramitec.de)

## NOVEMBER 2009

**5-6 Erding, Germany** *8th Colloquium High Velocity Oxy-Fuel Flame Spraying* - Visit GTS [www.gts-ev.de](http://www.gts-ev.de), <http://hvof.gts-ev.de> or Linde AG [www.lindegas.com](http://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](http://www.aws.org), Fabricators and Mfgs Assoc, [www.fmafabtech.com](http://www.fmafabtech.com), Soc. of Mfg. Engineers, [www.sme.org/fabtech](http://www.sme.org/fabtech)



## FEBRUARY 2010

**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](mailto:mtgserv@tms.org), web: [www.tms.org](http://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](http://www.messe-essen.de)

## APRIL 2010

**April, San Francisco, CA USA** *International Thermal Spray Association Membership Meeting and Technical Program* - contact ITSA, [itsa@thermalspray.org](mailto:itsa@thermalspray.org), 440.357.5400

*Is Your Event Listed? Send your event notice to [spraytime@thermalspray.org](mailto:spraytime@thermalspray.org)*


**19-22 Orlando, FL USA** *TechCon 2010 Society of Valuum Coaters 53rd Annual Technical Conference* - contact [www.svc.org](http://www.svc.org)

**21-24 Tokyo Japan** *Japan Int'l Welding Show 2010 sponsors include Japan Thermal Spraying Society* - contact email: [info@weldingshow.jp](mailto: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](http://www.asminternational.org), email: [customerservice@asminternational.org](mailto:customerservice@asminternational.org)

## JUNE 2010

**7-10 San Diego, CA USA** *MegaRust Navy Corrosion Conference* - visit  [www.nstcenter.com](http://www.nstcenter.com)

**11-13 Mexico City, Mexico** *AWS Weldmex* - visit [www.aws.org](http://www.aws.org)

**14-18 Glasgow, Scotland** *ASME Turbo Expo 2010 - Scottish Expo and Conference Center* - visit [www.turboexpo.org](http://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](mailto:tagungen@dvs-hg.de), web: [www.dvs-ev.de/loet2010](http://www.dvs-ev.de/loet2010)

## OCTOBER 2010

**10-14 Florence, Italy** *Powder Metallurgy World Congress & Exhibition* - visit [www.epma.com/pm2010](http://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](http://www.aws.org), Fabricators and Mfgs Assoc, [www.fmafabtech.com](http://www.fmafabtech.com), Soc. of Mfg. Engineers, [www.sme.org/fabtech](http://www.sme.org/fabtech)

**30NOV - 4DEC Boston, MA USA** *2010 MRS Fall Meeting* - visit [www.mrs.org](http://www.mrs.org)



**International Thermal Spray Conference and Exposition - ITSC 2010 - May 3- 5, 2010**

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**Gun Mounts for the Articulated Robot; Fibonacci Comes Through Again**

Dale Moody, Plasma Powders and Systems

Many articulated robot gun mounts in use today were originally designed for gantry or X-Y traversing manipulators. The use of these basic mounts results in a constrained operating window for robot motion during thermal spray operations. In addition, articulated robots are often positioned in the thermal spray cell before the gun mount configuration is established. This can also result in a less-than-ideal thermal spray arrangement.

The paper discusses the disadvantage of using "Angle Iron" gun mounts and discusses optimum designs. Interestingly enough, the near optimum design is based on the "Golden Triangle", a derivative of the Fibonacci Numbers series.

The paper also discusses the importance of establishing the gun mount before determining the positioning of the robot in the work area.

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**ASM Thermal Spray Society  
 Thermal Spray Technology Course**

October 28-30, 2009 8:00 AM - 5:00 PM

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ASM International will be offering a Thermal Spray Technology course during the Materials Science and Technology MS&T2009.

Instructors: Christopher C. Berndt, PhD, FASM, HoF; Professor, Swinburne University of Technology, Melbourne, Victoria, Australia, and Richard Knight, PhD, FASM, Auxiliary Professor, Drexel University, Philadelphia, Pennsylvania USA

This course provides a thorough grounding and understanding of thermal spray processes, presents the complex scientific concepts in terms of simple physical models, and integrates this knowledge to practical applications and accepted thermal spray practices. NO mathematics is used to explain the processes or materials/mechanical engineering.

Participants are encouraged to contact the instructor(s) prior to the course so that any particular application of problem can be discussed as a case history. Each registrant receives the "Handbook of Thermal Spray Technology".

**For more information and registration**, visit [www.asminternational.org/tss](http://www.asminternational.org/tss)

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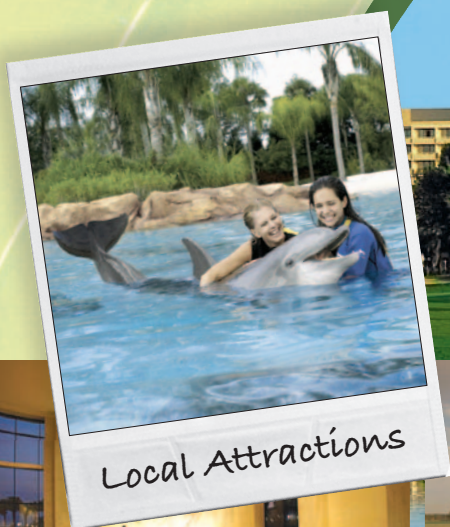
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## Greetings from JTSS New President



**Masahiro Fukumoto**  
Eighth President of the JTSS  
Toyohashi University of  
Technology

It is of my great pleasure and honor in informing you that I was elected as a new president of the Japan Thermal Spray Society, JTSS, on 15th of June, 2009.

As a leader of the organization, proudly having 50+ years tradition, I would like to promote whole activities of the society as much as I can. On the assumption of the office, I would like to make the following as our goal:

1. Strengthening activities of the five local branches and ten committees in the society.
2. Strengthening collaboration with the domestic academic organizations, especially with Japan Thermal Sprayers Association, and others such as Japan Welding Society.
3. Promotion of the participation in the ISO's progressing activities.
4. Collaboration enhancement with the foreign academic organizations and activities in Asian region and the rest of the world.

Through the four activities mentioned previously, I aim at making our society the place where young scientists and engineers putting together to be brought up in the Thermal Spray academic field. I also will take a leading role in the JTSS to contribute to the Japanese society in an effective manner.

I would appreciate it very much if you could extend your full support and cooperation to the JTSS.

Please share in welcoming Seiji Kuroda and Akira Nakahira as the New Management Vice Presidents.



**Seiji Kuroda**  
JTSS Vice President  
National Institute of  
Materials Science



**Akira Nakahira**  
JTSS Vice President  
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### Wall Colmonoy Employees

Wall Colmonoy announces the appointment of **Justin Madrid** as Production Manager for the Alloy Products Group.



Justin started his career at Wall Colmonoy Los Lunas in 2003, where he worked four years as the foundry supervisor. He was then promoted to production coordinator where he continued to gain valuable experience in all aspects of Wall Colmonoy's manufactured products.

Justin has a BS in business management and is starting

his MBA program in August.

In his new position, he will be overseeing foundry, extrudable paste, transfer tape, hard surfacing and brazing rod, brazing aids, and composite powder production.



Wall Colmonoy announces the appointment of **John Lapping** as Director of International Sales and Marketing for the Alloy Products Group.

John has more than 25 years experience in the thermal spray and high temperature brazing industry. John was with Wall Colmonoy Ltd for

seven years and returns to us after spending the last few years as works director and company secretary for glass plunger manufacture, Hunpreco, United Kingdom.

John will be responsible for our sales activity in the United States and Canada. Our North American field sales force will report to John.



Wall Colmonoy Corporation announces the appointment of **Lydia Lee** to Brazing Products Manager for their Alloy Products Group, based at their corporate offices in Madison Heights, MI.

Lydia received her Bachelor's and Master's Degree in Engineering from Tianjin University, China and her MBA

from Tulane University, Louisiana. Since joining Wall Colmonoy, Lydia has studied brazing with the late Robert Peaslee as her teacher and mentor.

All inquiries for brazing technical assistance should be directed to Lydia. She will continue to be assisted by our technical services manager, Mike Weinstein, brazing engineer, Eric Krosche and laboratory personnel working at our plant in Los Lunas, New Mexico.

**For further information**, please visit website [www.wallcolmonoy.com/alloyproductsgroup.html](http://www.wallcolmonoy.com/alloyproductsgroup.html)



### CenterLine Hires Account Manager

CenterLine (Windsor) Ltd. is very

pleased to announce that **Brad Dierickse** has joined CenterLine (Windsor) Limited as Account Manager.

Brad is a performance driven sales professional specializing in consultative business-to-business selling of industrial automation solutions and services. He brings to CenterLine 20 years of practical business experience in the industrial automation sector. He's held positions ranging from product marketing specialist, program manager, senior account manager and business development manager. Brad has significant knowledge of custom machine automation and advanced production systems. His range of experience and industry insight will greatly assist CenterLine in its ongoing development of its metal joining and coating products, systems and services.



CenterLine (Windsor) Limited is a recognized industry leader in the design, manufacture and supply of a full range of products and services satisfying welding, metalforming and cold spray applications for the automotive, mass transit, aerospace and defense industries. With over 50 years in business, CenterLine is continuing to develop advanced technologies and processes to assist its customers in maintaining their competitive advantage.

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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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You can request an online version only (no print copy will be sent to you) **or** both an online **and** a print copy

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

## Dr. Mark F. Smith Nominee for ASM International Vice President 2009-2010

**Dr. Mark F. Smith**, deputy director of Sandia National Laboratories Advanced Manufacturing Science and Technology Center, Albuquerque, New Mexico, is the nominee for the upcoming ASM International Vice Presidency.



Sandia Labs, a 300 person center, annually conducts nearly \$60 million of research and development to support various national security programs.

Dr. Smith joined Sandia in 1981. Since 1993, Dr. Smith has also served as an adjunct professor in the Department of Materials and Metallurgical Engineering at New Mexico Technical University. Before moving into technical management Sandia in 1999, Dr. Smith was best known for his pioneering work in thermal spray technology. He was instrumental in the pioneering cold spray research work conducted at Sandia with a consortium of eight United States companies.

Dr. Smith was recently inducted into the ASM Thermal Spray Society Thermal Spray Hall of Fame.

Dr. Smith received his graduate and undergraduate

degrees at Iowa State University. His father, Prof. John F. (Jack) Smith, is a retired professor of metallurgy and former department chair at Iowa State, who remains active with ASM International as editor of "Journal of Phase Equilibria and Diffusion". Jack and Mark are among the few living pairs of father-son Fellows of ASM International.



**Dr. Mark Smith, cover, SPRAYTIME first quarter 2002, article "Industry Warms up to Promises of Cold Spray".**

Mark Smith has a 30+ year record of service to ASM. He was one of a small group of thermal sprayers who approached ASM in the mid 1980s to form the Thermal Spray Technical Division (TSD), which later became the ASM Thermal Spray Society during his term as TSD Chairman. He was subsequently elected to an unprecedented three terms (nine years) on the ASM TSS Board, and helped to start the National Thermal Spray Conference which later became the International Thermal Spray Conference (ITSC). Dr. Smith was also the founding chairman of the Editorial Review Committee for the TSS "Journal of Thermal Spray Technology".

## Flame Spray Technologies Appoints Joris Kraak

Flame Spray Technologies announce the appointment of **Joris Kraak** to the position of Marketing and Sales



manager of Flame Spray Technologies. After Joris finished his study of commercial economics at the University in Utrecht he started to work for a thermal spray company in the Netherlands. He started gaining his experience by exhibiting a hands-on mentality and showing a deep interest in the technology.

After 5 years Joris was looking for a new challenge and



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joined FST where he initially was responsible for the Middle East and India. After being successful in this region, FST appointed him as the new global Marketing and Sales manager.

"Joris has a great experience in the field of thermal spraying and is a very driven and solution orientated person with great qualities, he is an outstanding addition to the FST team," says Menno Zwetsloot, managing director of FST.

**For more information**, contact Joris via email [J.Kraak@fst.nl](mailto:J.Kraak@fst.nl) or visit website [www.fst.nl](http://www.fst.nl)

### Lenling Appointed Chair of ASM Certification Committee

**William J. Lenling**, vice president and materials engineer,



Thermal Spray Technologies, Inc., Sun Prairie, WI, has been appointed chair of the ASM Certification Committee.

Bill has a BS and MS in Materials Science and Engineering from the University of Wisconsin-Madison.

He began working in the thermal spray industry in 1986 and has extensive experience in research and development, sales, and management. His graduate research at the University of Wisconsin was concentrated on thermal spray, and he spent fifteen months working at Sandia National Laboratories in Albuquerque, New Mexico studying the sciences of thermal spray. He has four thermal spray related patents, and has written and published several papers. Bill is an active member of ASM and ASM/TSS. Currently he is an elected member of the TSS Board and serves on the TSS Board's Executive Committee. He is the past chair of the TSS Training Committee. He currently is a member of the ASM Education Committee.

Bill is the Thermal Spray Technology representative for the International Thermal Spray Association (ITSA).

Bill is active in his children's school committees. He enjoys many outdoor sports including, skiing, biking, running and fishing. He is also a big Wisconsin Badger sports fan.

**For more information**, contact Bill via email [blenling@tstcoatings.com](mailto:blenling@tstcoatings.com) or visit website [www.tstcoatings.com](http://www.tstcoatings.com)

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### Farr APC Appoints Goodspeed to Thermal Spray Market Manager

Farr Air Pollution Control (APC), a leading manufacturer of dust and fume collection equipment, has appointed **Scott R. Goodspeed** to the newly created position of thermal spray market manager.

Goodspeed has 36 years of sales, managerial and technical experience in the thermal spray industry. He most recently served as a regional sales manager for H.C. Starck, Inc. (Newton, Mass.), with responsibilities for material sales, thermal spray training and other programs. He has also held sales and management posts with Plasma Technology Incorporated, Praxair Surface Technologies, Miller Thermal, and Bay State Abrasives, Inc.

Goodspeed is a long-standing member of the International Thermal Spray Association (ITSA) and a past chairman (2001-3), vice chairman (1999-2001) and associate chairman (1990-6) of that organization. He is also a member of ASM International (ASM), the ASM Thermal Spray Society (TSS), and the American Welding Society (AWS), where he served for many years on the Committee for Thermal Spraying (AWS C2). He has 25 years community service as a firefighter.

In his new post, Goodspeed will oversee all aspects of Farr APC's growing thermal spray dust collection business. Farr APC manufactures a full line of dust and fume collectors and filters that improve operating efficiency, enhance safety, and solve environmental compliance challenges for all types of thermal and flame spray processes.

Farr APC is a member of Camfil Farr, the largest air filter manufacturer in the world.

**For more information**, contact Scott Goodspeed via email [goodspeeds@farrapc.com](mailto:goodspeeds@farrapc.com) or Farr Air Pollution Control, 3505 South Airport Road, Jonesboro, AR 72401; via email [filterman@farrapc.com](mailto:filterman@farrapc.com), phone 800.479.6801; fax 800.222.6891; website [www.farrapc.com](http://www.farrapc.com)



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### Three Inducted Into ASM Thermal Spray Hall of Fame

Three leaders and innovators who have shaped the past, present and future of thermal spray technology will be inducted into the Thermal Spray Hall of Fame this May.

The Hall of Fame was established in 1993 by the ASM Thermal Spray Society to recognize and honor outstanding leaders who have made significant contributions to the science, technology, practice, education, management and advancement of Thermal Spraying. "The Hall of Fame is a bond between our industry's past and its future," said TSS President Mitch Dorfman, Sulzer Metco (US). The inductees for 2009 are:

**Daryl E. Crammer**, Thermal Spray Technologies, Inc.



"For advancing thermal spray technology through numerous innovations in equipment and process design, and for being an invaluable source of information and advice to the thermal spray community."

Crammer's 37 year career in thermal spray began in 1972, when he joined Battelle Memorial Institute. He is currently the Director of

Technology for Thermal Spray Technologies in Sun Prairie, Wisc. Crammer's career in thermal spray has included R&D, engineering, manufacturing and most important, mentoring. "Daryl's greatest satisfaction has come from impacting the lives of others and supporting their success," Dorfman said.

**Akira Nakahira**, TOCALO Co., Ltd.



"For the development and industrialization of innovative thermal spray coatings, fostering one of the world's largest thermal spray job shop companies, and for the advancement of thermal spray as a fundamental technology."

Nakahira is chairman and CEO of TOCALO Co., Ltd., and

president of the Japan Thermal Sprayers Association. He has been engaged in the thermal spray business, including sales, production, R&D and management, for 51 years. He was the vice chair for two leading worldwide thermal spray events, ITSC '95 in Kobe and ITSC 2004 in Osaka.

**Anatolii N. Papyrin**, Cold Spray Technology, LLC

"For outstanding scientific and technological contributions to the research and development as well as the commercialization of the cold spray process."

The president of Cold Spray Technology LLC in Albuquerque, N.M., Papyrin supervised the R&D work that led to the creation of the cold spray process. Since 1994, he has worked on developing and improving cold spray at the National Center for



Manufacturing Science in Ann Arbor, Mich., at Pennsylvania State University, and at Ktech Corporation in Albuquerque.

The three Hall of Fame inductees were acknowledged during the Plenary Session of the International Thermal Spray Conference (ITSC) on May 4, in Las Vegas.

**For more information** about the ASM Thermal Spray Society Hall of Fame, visit the ASM TSS website [www.asminternational.org/tss](http://www.asminternational.org/tss)

### A Sales Legend Retires

Mr. **John Bonar** has retired after a long successful career spanning more than 20 years in thermal spray. John managed the sales division at Engelhard Surface Technologies and helped grow their business into a successful global thermal spray company. In recent years, he managed sales for the Metallizing Service Company (MSC) in the mid west region.

John is very well known in business and has superior knowledge in the thermal spray industry and industrial manufacturing. He's not only a talented sales manager, he was more than that, building many friendships wherever he went and could always be counted on for his strong technical knowledge and mentoring approach. His personal style as a gentleman has allowed people to work together for mutual success on many projects.

The thermal spray industry is losing a valuable asset, but one who deserves his time in the sun.

**Best Wishes John!**

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### WHERE IS YOUR ARTICLE?

The **SPRAYTIME** Editorial Staff encourages and welcomes your contribution.



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