INTERNATIONAL THERMAL SPRAY ASSOCIATION

THERMAL SPRAY TECHNOLOGY: HIGH-PERFORMANCE SURFACES

Design Considerations for Thermal Spray Coatings
Thermal Spraying is certainly a specialized process, but the end result (coating) has played a significant role in everyday industrial and commercial products around the globe. Coatings are used to change surface properties, improve product performance, extend service life and reclaim worn components back into service. A successful business model today must develop, test and bring to market a new product on a precise time line leaving little room for poor performance or re-engineering activity. This presentation will review some of the common design considerations needed for selecting a thermal spray coating and provide some typical examples of success and failure in the design process.
Raymond J. Sinatra, Rolls Royce Corporation

Cost Implications of Cascaded High Efficiency Plasma Spray Processes
Plasma spray coating costs are highly dependent on the rate of material deposition. As a consequence the power of plasma spray systems introduced into the market has consistently increased with time as a means of increasing deposition rates. Cascaded plasma spray technology has more recently shown the ability to increase deposition rates through increases in efficiency. Examples will show that by using material more efficiently and consuming less energy and other utilities, the cost of coating application can be significantly reduced.
Omar Sabouni, Sulzer Metco

Experimental Investigation of Ultra-Smooth Hardface Coatings Applied by Advanced HVOF Process
Many industrial applications, such as landing gear, compressor blades, valves and gates, require the surface properties of high hardness, superior finishing and strong adhesion to provide satisfactory wear and erosion resistance and mechanical integrity. In this work, an improved HVOF process is developed and investigated for applying hardface coatings with near-netshape and ultra smooth as-sprayed surface compared to those fabricated by a conventional HVOF process. This would provide a significant step forward in streamlining the manufacturing process and potentially cost.
Xinqing Ma, Curtiss-Wright Surface Technologies

Noise Abatement and Safety for HVAF and Cold Spray
Cold Spray, HVAF and Other High Noise Level Technologies Require New Approaches to Sound Abatement Safety. With the introduction of new technologies to thermal spray such as cold spray and High Velocity Air Fuel (HVAF), advanced noise abatement equipment and new techniques for sound control are necessary to protect worker safety. Both of these processes produce high levels of high frequency noise. High frequency noise presents unique challenges from a sound containment perspective. A basic technical discussion of sound wave profiles and how they relate to thermal spray will be included. New technologies for spray booth design which have been developed for cold spray and HVAF in order to keep noise levels at or below 85 DBA will be detailed. Special consideration must be given to wall panels, doors, windows and other opening such as overhead roof hatch access for cranes. The paper will also review basic noise safety considerations and noise abatement techniques for established processes including HVOF, plasma arc spray, electric wire arc and D-Gun™.
Scott McLaughlin, McLaughlin & Associates
Thermal Spray, Inc.
Quality Thermal Spray
Thermal spray as a whole is one operation, but a closer look reveals more than one step to insuring a quality outcome. This presentation will show how AWI has evolved as we understand and focus in on the quality that each step provides to the end product. As in all repair processes there are many variables that can contribute to the end product. How we control and minimize mistakes with these variables is what makes our company a leader in the industry.
Jory Wright, Accuwright Industries

Performance Comparison of Standard and Modified NiCrMo Alloy C HVOF Coatings, and Their Use as Alloy Matrix for Tungsten Carbide Composites
NiCrMo alloys are commonly used for their exceptional resistance to highly corrosive service environments in the paper processing, chemical, petrochemical, and other industries. Corrosion there can be a significant, costly and time-consuming maintenance problem. Here, HVOF coatings of a modified Alloy C are compared with those of conventional Alloy C. The modified alloy exhibits significantly improved corrosion resistance and grind finish ability over the conventional alloy. The addition of carbides, such as tungsten carbide, to improve wear performance is also discussed. Current and potential applications are also presented.
Robert A. Miller, Kennametal Stellite

Thermal Spray and the Starving Artist
Many artists and art restorers have developed or restored works that benefit from the unique properties provided by Thermal Spray operations. The Thermal Spray system of the artist may differ significantly from the system of a standard job-shop. For example, artists are usually not concerned with high production rates, automation and specialty coatings such as thermal barrier coatings and tungsten-carbide coatings. On the other hand, artists and art restorers are interested in systems that can lay down a fine, precise coating with good accuracy, one that is versatile, able to handle a variety of materials, and, as indicated by the title, one that fits within the budget of a starving artist. This paper presents a review of Thermal Spray in the world of art, discusses the various ways that Thermal Spray is being used for art and covers the requirements for a system specifically configured for the artist and the art restorer.
Dale Moody, Plasma Powders and Systems

Make or Buy, Determining the Total Costs of Operating a Thermal Spray Facility
Whether they feel deliveries aren’t fast enough, or the price for the product seems unnecessarily high, many regular consumers of thermal sprayed coatings consider the option of developing their own captive thermal spray capacity. Some even go so far as to get quotations for a gun or two and are encouraged enough to pursue the issue further. Very few, however, complete the project and take the process in-house. This presentation will discuss the fundamental requirements for a basic commercial thermal spray facility and the costs involved, in order to establish a realistic hurdle an OEM might need to meet in order to justify bringing thermal spray coating operations under their roof.
Daniel C. Hayden, Hayden Corporation

Thermal Spray Methods and Equipment – 1800s Through the 1930s
Many people, when first learning about the thermal spray method, are often quite shocked when they are told that this method of applying coatings has been in use for over 100 years. While we in the thermal spray industry tend to focus on the latest thermal spray equipment technology, it is quite interesting to look back at the discoveries and application methods of the past. It is fascinating to see how far we have come and yet how close we still are to the roots and origins of thermal spray. This informative paper will discuss these early methods and compare them to some of their modern counterparts. Along with this paper there will be some actual examples of antique thermal spray equipment displayed.
James Weber, Sulzer Chemtech USA
Modeling of a Controller for a Thermal Spraying System
There are a number of thermal spraying systems, which are based on High Velocity Air Flame (HVAF) processes. Stable control of HVAF systems is difficult to achieve due to the complexity of the combustion process in a small burner and because of a number of varying process parameters. Therefore, modeling of a control of HVAF systems can provide useful information in optimizing the performance of a thermal spraying system. In this research, a basic model of a HVAF controller has been developed using Matlab/Simulink. The control model consists of sub-models of various stages and units of the control system, such as: air and fuel supply models, combustion model, burner and nozzle models. The developed model was applied and evaluated using a thermal spraying controller, which was developed previously. The obtained results indicate that the developed simplified model of HVAF controller provides the main required control parameter, the fuel-air ratio, which corresponds with the value used in the actual control of the thermal spraying system.
Igor Gorlach, Nelson Mandela Metropolitan University

Robotic Laser Cladding
A laser cladding system concept with similarities to thermal spray equipment solutions will be presented, combining a high-power laser, powder feeding equipment and a robot handling with a dedicated laser cladding system controller in a laser-safe housing.
Thomas Peters, Sulzer Metco AG

Corrosion and Protection Offered by a Dispersed Oxide Coating System
It has been well documented that the use of municipal waste as fuel to produce steam in Waste-to-Energy (WTE) boilers causes severe corrosion on the internal surfaces in these environments. The current remedy for such corrosion problems has been the use of weld overlays containing Nickel and the oxide forming elements such as Aluminum and Chromium. Although in the past, weld overlays have proven beneficial in halting such corrosion, it now appears that the current operating conditions coupled with unique maintenance practices have placed exceedingly difficult demands on the weld overlay’s ability to mitigate corrosion. This paper, in cooperation with an industry leading producer of electricity using municipal waste as their primary fuel, will detail a two year corrosion study performed at a WTE facility known for its excessive corrosion problems. This study will present the operating conditions, maintenance practices, and the coating application technology used. The results of this study has provided us with insights on the many different scenarios that are capable of causing corrosion and the protection that is offered by a Dispersed Oxide coating system.
David J. Urevich, ArcMelt Company

A New Arc Spray Amorphous Alloy for Wear Applications
Cored wire technology for thermal spraying allows the use of unique alloys that are not available in solid wire form. This paper discussed new developments in cored wires for thermal spraying including amorphous, nano and self-fluxing alloys. A discussion of successful applications for these alloys is included.
Bob Unger, Polymet Corporation

Capability of Combined Thermal Spray and Laser Coating Centers to Improve Production Efficiency
Novel coating centers permit control of both thermal spray and laser based surface treatment processes. Laser cladding production rates and efficiencies can be improved with the incorporation of substrate and feed stock material preheating techniques. The benefit of these techniques to the basic laser cladding process are presented and evaluated in relation to their impact on industrial production. Industrial applications including, hydraulic pistons, excavation tools, ball valves, drive shafts, continuous casting copper molds and pot rolls for continuous galvanizing lines in steel mills, are used to demonstrate this modified laser cladding processes in combination with thermal spray processes.
Alan Burgess, SprayWerx Technologies
Recent Advances in Materials and New Industries Entering the Thermal Spray Field – Thermal Spray Equipment for Use in These Industries and Applications

Advances in materials along with newer industries joining the thermal spray field occur every several years. This talk will briefly discuss the class of ultrafine and near-nano grained materials entering the thermal spray industry. Thermal sprayed coatings produced from ultrafine and near-nano grained powders provide improved properties as compared to conventional (micron size) powders. These materials show significant potential for many industry applications (aerospace, oil & gas, industrial gas turbine). Sintered (SPS) ultrafine and near-nano light alloys (Al-, titanium-based) will be discussed as well as high velocity oxygen-fuel (HVOF) sprayed WCCo- Cr and WC-Co carbides. Several industries have made a notable contribution to the thermal spray industry over the past several years. A brief review of one of these, the electronics industry entering the thermal spray industry will be discussed. And lastly, with the advancements in materials and industries, we see the advancements in equipment(s) and operations in supporting the higher requirements required by these industries. This ranges from mass-flow controlled equipment- to robotics, to vacuum plasma spray chamber usage in solar, electronics, and semiconductor applications to meet high purity (e.g., low oxygen, phase stability) requirements of these coatings.

Robert Gansert, Advanced Materials and Technology Services