

In The News

Recent Conferences

International Thermal Spray Conference & Exposition ITSC 2007

May 14-16, 2007, Beijing, China

This international conference and exposition for thermal spray technologists, researchers, manufacturers, and suppliers was held May 14-16, 2007, at the Beijing International Convention Center in Beijing, China. An international delegation of materials and design engineers, research scientists, manufacturers, suppliers, and users gathered to exchange ideas on meeting the challenges and opportunities of the years to come.

There were 55 sessions, and more than 290 presentations and 40 posters at ITSC 2007 that provided the most important source of thermal spray technical information available in 2007. The conference has been highly successful, with more than 400 conference attendees and more than 300 “expo only” attendees. A total of 45 exhibiting companies and organizations brought the best of thermal spray technology to the exhibit floor.

This world’s thermal spray event was held for the first time in Beijing. TSS President Peter Hanneforth said “China represents one of the greatest opportunities for our industry in terms of potential markets for products and services, sourcing initiatives, joint venture projects in manufacturing, and research and development.”

ITSC 2007 Awards

Professor Richard Knight presented the 2007 ITSC Best Paper Awards and Certificates of Merit at the banquet.

Best Paper Awards: “Processing and Properties of Yttria-Stabilized Zirconia TBCs Produced Using Nitrogen as Primary Plasma Gas,” *Basil Marple*, Rogerio Lima, Christian Moreau, Silvio Kruger, National Research Council of Canada, Boucherville, Canada; Liangde Xie, Mitch Dorfman, Sulzer Metco (US), Inc., Westbury, NY.

“Properties and Performance of High Purity Thermal Barrier Coatings,” *Mitch Dorfman*, Liangde Xie, Westbury, NY; Amaia Cipria, Paul Shiladitya, Igor Golosnoy, T. W. Clyne, Cambridge University, Cambridge, U.K.; Weiquang Chi, Vasudevan Srinivasan, State University of New York, Stony Brook, NY.

“Influence of Annealing Treatment on the Photocatalytic Performance of the Nanostructured TiO₂ Coating Deposited by Vacuum Cold Spray,” *Guan-Jun Yang*, Chang-Jiu Li, Sheng-Qiang Fan, Ling-Zi Zhang, Cheng-Xin Li, Yu-Yue Wang, Xi’an Jiatong University, Xi’an, PRC.

“Evaluation of Strain Field Around Impacted Particles by Applying Electron Moiré Method,” *Makoto Watanabe*, Sathoshi Kishimoto, Kentaro Shinoda, Seiji Kurodo, National Institute for Materials Science, Ibaraki, Japan.

“Sintering Kinetics of Plasma Sprayed Zirconia TBCs,” *Amaia Cipria*, Igor Golosnoy, T. W. Clyne, Cambridge University, Cambridge, U.K.

“Influence of Plasma Instabilities in Ceramic Suspension Plasma Spraying,” *Ramuntxo Etchart-Salas*, V. Rat, J.-F. Coudert, Pierre Fauchais, University of Limoges, Limoges, France.

“Fast Modeling of Phase Changes in a Particle Injected Within a D.C. Plasma Jet,” *Pierre Fauchais*, Fadhel Ben Ettouil, Olga Mazhorova, Bernard



The Great Wall of China, one of the Seven Wonders of the World



ITSC 2007 Awards Ceremony



Amaia Cipitria receives a 2007 ITSC Best Paper Award from Richard Knight

Pateyron, Helene Ageorges, Mohamed El Ganaoui, University of Limoges, Limoges, France.

Certificates of Merit: “Microstructure Control of Thermally Sprayed Co-Based Self-Fluxing Alloy Coatings by Diffusion Treatment,” *Kazunori Sakata*, Fujikikosan Corporation, Kitakyushu, Japan; Kosuke Nakano, Hirofumi Miyahara, Kyushu University, Fukuoka, Japan; Yasuhiro Matsubara, Kurume National College of Technology, Dazaifu, Japan; Keisaku Ogi, Oita National College of Technology, Oita, Japan.



Ramuntxo Etchart-Salas receives a 2007 ITSC Best Paper Award from Prof. Richard Knight

“Effect of Microstructure of HVOF-Sprayed WC-Co Coatings on Their Mechanical Properties,” *Pornthep Chivavibul*, Makoto Watanabe, Seiji Kurodo, National Institute for Materials Science, Ibaraki-ken, Japan.

“Erosion Properties of Plasma Sprayed Ceramic Coatings Against Process Plasma in Semiconductor Production Equipments,” *Junya Kitamura*, Hiroyuki Ibe, Hiroaki Mizuno, Isao Aoki, Fujimi Incorporated, Kakamigahara, Japan.

“Rapid and Continuous Deposition of Porous Nanocrystalline SnO₂ Coatings

with Interpenetrating Pores for Gas Sensor Applications,” *Chun-Lin Chen*, University of Toronto, Toronto, Canada.

“To Achieve Epitaxy Thermal Spraying by Substrate Melting,” *Lili Zheng*, Guanghua Wei, Wei Zhang, Hui Zhang, State University of New York, Stony Brook, NY.

“Liquid Precursor Plasma Spraying: Modeling the Interactions Between the Transient Plasma Jet and the Droplets,” *Armelle Vardelle*, Cecile Marchand, Christophe Chazelas, University of Limoges, Limoges, France.

Papers Recognized by the Chinese Organizing Committee

“Development of Simulating Tester for Evaluation of Build-Up Characterizing in CAL Hearth Rolls,” X.O. Huang, R.J. Wang, T.J. Zhang, C. Zhang, J.L. Cheng, Surface Engineering Research Institute of CAAMS, Beijing, People’s Republic of China; Y.M. Li, G. Bi, Y.G. Zhang, X.H. Tan, Shanghai BaoSteel Equipment Maintenance Co., Ltd., Shanghai, People’s Republic of China.

“Influence of H₂SO₄ Treatment on Biological Properties of Plasma Sprayed Titania Coatings,” *C. Ding*, B. Li, X. Liu, Shanghai Institute of Ceramics, Chinese Academy of Science, Shanghai, People’s Republic of China.



HVOF Colloquium chairman Peter Heinrich, Linde AG, Linde Gas Division, Unterschleissheim, Germany

HVOF: Latest Developments Improve Economic Efficiency in Surface Treatment

Seventh Colloquium on High-Velocity Flame Spraying, November 9-10, 2006, Erding, Germany

The Seventh Colloquium on high-velocity flame spraying, which was held Nov 9-10, 2006 in Erding near Munich, was organized by GTS Gemeinschaft Thermisches Spritzen e.V. together with its partners—the German Armed Forces University in Hamburg, SLV München, Niederlassung der GSI mbh, and Linde AG, Linde Gas Division. Four hundred twenty-one participants from 23 countries and from 215 different companies had accepted the invitation to find out more about the latest developments and research results for the high-velocity oxyfuel (HVOF) process or to report themselves on their experiences of and applications for

optimum surface coating. This marked an increase in participant numbers of around 12% compared with the last event in 2003. Almost a quarter of the participants came from non-German-speaking countries.

At the start of the Colloquium, Prof. Dr. Heinrich Kreye from the German Armed Forces University in Hamburg reported on the current state of our understanding of cold gas spraying, in which the particles adhere solely because of their high kinetic energy and the deformation on impact. The particles are accelerated in a Laval nozzle with the help of a preheated gas under high pressure. In contrast with conventional thermal spraying, the particles are just slightly heated and impact the substrate in a solid state. Through the expansion of the gas in the divergent area of the nozzle, the gas and particles accelerate to ultrasonic speed and cool down. Professor Kreye vividly compared this process with a snowball that is thrown against a wall. This too will only stick if the speed and the consistency of the snow are right. Further discussion addressed many important subjects, such as the spray rate for cold gas spraying, which is comparable with other thermal spraying methods, effect of impact speeds and nozzle shape, influence of the shape and size of the particles, the type of process gas, and the state of the process gas in terms of pressure and temperature.

Cold gas spraying is now an integral part of many industries, including the aerospace industry. The approval of the use of the process in this demanding industry proves that, for the processing and finishing of all different types of surfaces, there is a new, convincing aspect that has already proved successful in practice. Dr. Thorsten Stoltenhoff from Praxair Surface Technologies GmbH spoke openly about their applications. He talked about the coating of dynamically highly stressed aerospace components made from aluminum using cold gas spraying used, for example, in engine technology or for the coating of rotor blades. The process has produced considerable improvements in performance in engine technology in particular.

There are very promising, up-and-coming markets for cold gas spraying in the United States and Australia. Both

countries have a wide degree of experience with HVOF processes, and it is now possible to build upon it with the new cold gas spraying process. In the United States, studies on cold gas spraying are being carried out in many research facilities, mainly led by ASB Industries. It is one of the goals of the CISRO Institute of Management to offer, at U.S. research facilities, innovative and flexible training programs that provide a link between traditional teaching institutions and the demands of the market. High-velocity oxyfuel spraying has become established in particular in the metal and steel industry, in which it is used mainly to proven protection against wear, according to Charles Kay from ASB Industries, United States. In Australia, there has been a cold gas spraying working group since 2003. Dr. Mahnaz Jahedi from CSIRO (Commonwealth Scientific and Industrial Research Organization) Manufacturing and Materials Technology, Australia, explained that cold gas processes are increasingly replacing traditional processes for coating, since they cause less environmental pollution and often offer better protection against oxidation.

Dr. Frank Gärtner from the German Armed Forces University in Hamburg referred in his presentation to the approaching 100th birthday of thermal spraying. This is a very successful sector with great promise for the future, with annual growth rates of 10% and more. High-velocity flame spraying is the fastest-growing area of thermal spray applications. Various HVOF spray systems are competing in the market, depending on the coating properties required. The latest developments in HVOF spray systems are aimed primarily at optimizing combustion and at improving particle acceleration or HVOF nozzles that operate at higher pressure.

In comparison with HVOF spraying with powder, HVOF combustion wire spraying is an economic alternative because of the lower investment and running costs for the necessary plant technology, according to Prof. Dr. Bernhard Wielage from the Technical University in Chemnitz. With combustion wire spraying, it is mainly simple systems using combustion gas and compressed air cooling that are used. The uncomplicated handling is an advantage, but the limited choice of spray materials is a disadvantage. The precondition for high coating qualities is the

homogenous melting of the wire tips. This requires precise coordination of the flame parameters, speed of the forward movement of the wire and the wire design.

Expectations for the Future

Many other topics were also presented and discussed in Erding, such as arc jet spraying, certification, and training. There was also a lively exchange of information at the exhibitors' stands. Visitors were able to find out about the latest state of technology and the most recent developments in systems, applications, and materials. However, there was one sad moment: at the Colloquium, Professor Kreye announced that he would be retiring after many years of active service for this forum.

The extremely lively event, with its presentations, exhibitors, discussions, and talks showed that thermal spraying is now a well-established process for applying coatings to metal surfaces to provide protection against wear, corrosion, or heat. High-velocity flame spraying has become an increasingly cost-effective process for which many new applications are set to open up in the future.

Colloquium chairman Peter Heinrich closed the event with a call to develop new systems over the coming 3 years so that the standard of the next Colloquium in 2009 could be just as high as this year's.

Contact: Peter Heinrich, Managing Director, GTS Gemeinschaft Thermisches Spritzen e.V., c/o Linde AG, Linde Gas Division, Carl-von-Linde-Str. 25, 85716 Unterschleißheim; Tel: 089-31001-564; Fax: 089-31001-585; E-mail: info@gts-ev.de; Web: www.gts-ev.de..

International Symposium on Advances of Thermal Spray Coatings Development (ISATSC'07)

May 18-21, 2007, Xi'an, China

The International Symposium on Advances of Thermal Spray Coatings Development (ISATSC'07) took place this Spring (May 18-21, 2007) in Xi'an, the capital of the Shaanxi province of China.

Organized by the State Key Laboratory for Mechanical Behavior of Materials of the Xi'an Jiaotong



A taste of the Garden of Felicity in Lingtong, near Xi'an



The delegates participating in the ISATSC Symposium



Professor J.-C. Li, organizer of the ISATSC Symposium and head of the Thermal Spray Lab., Xi'an Jiaotong University, giving the welcoming remarks at the opening of the symposium

University, sponsored by Xi'an Jiaotong University and supported by China 973 Program (2007CB707700), Science and Technology Bureau of Xi'an, Shaanxi YuFeng Mechatronics Co. Ltd and Shanghai Junshan Surface Technology Engineering Co. Ltd.,

ISATSC'07 welcomed more than 60 researchers, industrial representatives, and students representing research institutions and companies from seven countries.

The objective of this seminar organized by Professor Chang-Jiu Li, head of the Thermal Spray Laboratory, State Key Laboratory for Mechanical Behavior of Materials of the Xi'an Jiaotong University, was to review recent progress made on the understanding of thermal spray fundamentals, focusing on the coating development including particle impact and flattening behavior, coating microstructure evaluation, and relationships between processes, microstructure, and properties.

This symposium was indeed designed to promote open exchanges among scientists in the field. Three sessions permitted intense and passionate debates around 21 presentations of 30 min, each focused on three topics: (1) recent developments in thermal barrier coatings, (2) recent advances in

the understanding of splat formation, and (3) coating microstructure and new processes for advanced coating development and applications.

The delegates had also the unique opportunity to visit the State Key Laboratory for Mechanical Behavior of Materials of the Xi'an Jiaotong University, including the Thermal Spray Laboratory. The delegates noted the very interesting and innovative research carried out on coatings developments, including plasma spray, supersonic flame, and cold gas spray. In particular, the deep investment of the laboratory in the development of high-temperature solid oxyfuel cells (SOFCs) by plasma spraying gained wide attention from the delegates.

The delegates of the symposium were able to visit the Terra Cotta Warriors Army of Emperor Qin Shi Huang, the Xi'an City Walls, the Garden of Felicity in Lingtong, among the several visits organized by the Chinese hosts.