

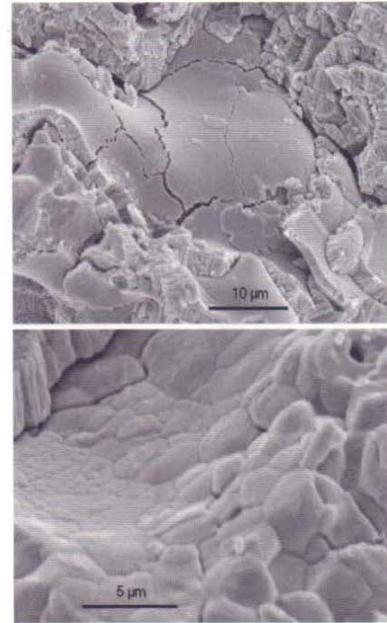
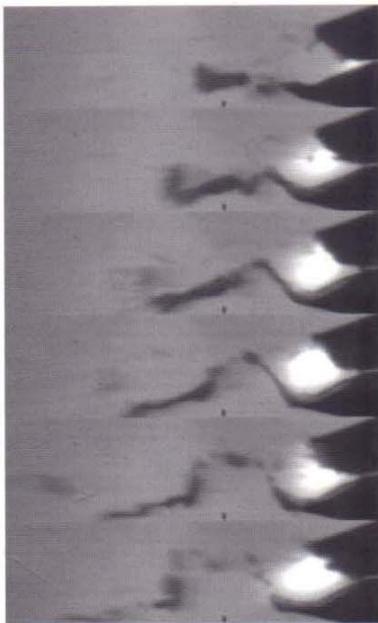
Thermal Spray 2003

Advancing the Science
and Applying the Technology

Volume One

5–8 May 2003

PROCEEDINGS OF THE INTERNATIONAL THERMAL SPRAY CONFERENCE



Edited by

Basil R. Marple and Christian Moreau

 **TSS**
ASM Thermal Spray Society
An Affiliate Society of ASM International

DVS German Welding Society
(Deutscher Verband für
Schweisstechnik-DVS)



International
Institute of Welding

Contents

Volume 1

Cold Spray

Numerical and Microstructural Investigations of the Bonding Mechanisms in Cold Spraying	1
<i>F. Gaertner, C. Borchers, T. Stoltenhoff, H. Kreye, University of the Federal Armed Forces Hamburg, Germany</i>	
<i>H. Assadi, Tarbiat Modarres University, Tehran, Iran</i>	
High Strain Rate Deformation Phenomena in Explosive Powder Compaction and Cold Gas Spraying	9
<i>T. Schmidt, F. Gaertner, H. Kreye, University of Federal Armed Forces, Hamburg, Germany</i>	
Optimizing the Cold Spray Process	19
<i>R. Dykhuizen, R. Neiser, Sandia National Laboratories, Albuquerque, New Mexico, USA</i>	
Modeling of Particle-Substrate Adhesive Interaction Under the Cold Spray Process	27
<i>A. Papyrin, Ktech Corporation, Albuquerque, New Mexico, USA</i>	
<i>S.V. Klinkov, V.F. Kosarev, ITAM, Novosibirsk, Russia</i>	
A Systematic Approach to Material Eligibility for the Cold Spray Process	37
<i>J. Vlcek, L. Gimeno, H. Huber, EADS GmbH, Ottobrunn, Germany</i>	
<i>E. Lugscheider, Material Science Institute, University of Technology, Aachen, Germany</i>	
Particle-Substrate Interactions in Cold Gas Dynamic Spraying	45
<i>D. Zhang, P. Shipway, G. McCartney, University of Nottingham, Nottingham, United Kingdom</i>	
Evaluation of Coatings Produced via Kinetic and Cold Spray Processes	53
<i>J. Smith, T. Van Steenkiste, Delphi Research Labs, Shelby Township, Michigan, USA</i>	
Potential Applications of Cold-Spray Technology in Automotive Manufacturing	63
<i>R. McCune, Ford Motor Company, Dearborn, Michigan, USA</i>	
Development of Cold Gas Sprayed Coatings	71
<i>J. Voyer, T. Stoltenhoff, H. Kreye, University of the Federal Armed Forces, Hamburg, Germany</i>	
Cold Spray Copper Application for Upper Stage Rocket Engine Design	79
<i>J. Haynes, Pratt & Whitney Space Propulsion, Jupiter, Florida, USA</i>	
<i>J. Karthikeyan, ASB Industries, Inc., Barberton, Ohio, USA</i>	
Kinetic Spray of Aluminum Metal Matrix Composites for Thermal Management Applications	85
<i>D. Morelli, A. Elmoursi, T. Vansteenkiste, D. Gorkiewicz, B. Gillispie, Delphi Research Labs, Shelby, Michigan, USA</i>	
Effect of Spray Angle on Deposition Characteristics in Cold Spraying	91
<i>C.-J. Li, W.-Y. Li, Y.-Y. Wang, Xi'an Jiaotong University, Xi'an, Shaanxi, P.R.China</i>	
<i>H. Fukanuma, Plasma Giken Co., Saitama, Japan</i>	

Cold Spraying - Equipment and Application Trends	97
<i>W. Kroemmer, P. Heinrich, Linde AG, Unterschleissheim, Germany</i>	
<i>P. Richter, CGT GmbH, Ampfing, Germany</i>	
Automated Cold Spray System: Description of Equipment and Performance Data	103
<i>R. Blose, T. Roemer, D. Beatty, A. Mayer, A. Papyrin, Ktech Corporation, Albuquerque, New Mexico, USA</i>	
Helium Recovery: Design Considerations for Cold Spray Systems	113
<i>S. Jaynes, F. Lauricella, Praxair Inc.</i>	
Cold Spray Technology: An Industrial Perspective.....	117
<i>K. Karthikeyan, C. Kay, ASB Industries, Inc, Barberton, Ohio, USA</i>	

Applications

Production Coating Cost Comparison	123
<i>P. Meyer, W. Rusch, Sulzer Metco (US) Inc., Westbury, New York, USA</i>	
Thermal Spray Solutions for Diesel Engine Piston Rings	129
<i>C. Herbst-Dederichs, Federal Mogul Burscheid GmbH, Germany</i>	
Low-Cost High-Performance Coatings Produced by Internal Plasma Spraying for the Production of High Efficiency Engines	139
<i>G. Barbezat, Sulzer Metco AG, Wohlen, Switzerland</i>	
Development of Thermal Spray for Automotive Cylinder Bores.....	143
<i>D. Cook, M. Zaluzec, Ford Motor Company, Dearborn, Michigan, USA</i>	
<i>K. Kowalsky, Flame Spray Industries, Port Washington, New York, USA</i>	
316L - An Alternative to NiCr Bondcoats for Cr₂O₃-Coatings on Anilox Rolls.....	149
<i>S. Hartmann, R. Winkler, F. Bueltmann, SLV Duisburg, NL der GSI mbH, Duisburg, Germany</i>	
<i>H. Burkard, Carpenter Powder Products GmbH, Düsseldorf, Germany</i>	
Plasma-Sprayed Ceramic Coatings for Molten Metal Environments.....	153
<i>K. Hollis, M. Peters, B. Bartram, Los Alamos National Laboratory, Los Alamos, New Mexico, USA</i>	
Influence of Powder Size in Aluminum Oxide Coatings for Use in the Semiconductor Industry.....	159
<i>R. Gansert, Hardface Alloys, Inc., Santa Fe Springs, California, USA</i>	
Intermediate Temperature SOFC Based on Fully Integrated Plasma Sprayed Components.....	163
<i>X.Q. Ma, S. Hui, Inframat Corporation, Farmington, Connecticut, USA</i>	
<i>H. Zhang, J. Dai, J. Roth, T.D. Xiao, and D.E. Reisner, US Nanocorp, Inc., Farmington, Connecticut, USA</i>	
Investigation of the Photocatalytic Efficiencies of Plasma Sprayed TiO₂-Fe₃O₄ Coatings	169
<i>F. Ye, A. Ohmori, Joining and Welding Research Institute, Osaka University, Osaka, Japan</i>	
<i>C.-J Li, Welding Research Institute, School of Mechanical Engineering, Xi'an Jiaotong University, Shaanxi, PR China</i>	
Protection of Titanium Alloy Surfaces by Thermal Spraying and Laser Treatment.....	175
<i>B. Wielage, A. Wank, H. Podlesak, K. Matthes, G. Kolbe, Chemnitz University of Technology, Chemnitz, Germany</i>	
<i>J. Wilden, Ilmenau Technical University, Ilmenau, Germany</i>	

Fabrication of TiO₂ Photocatalytic Coatings on PET by Thermal Spraying	183
<i>T. Kanazawa, A. Ohmori, Osaka University, Osaka, Japan</i>	
Photocatalytic Decomposition of Ammonia by Thermal Sprayed TiO₂ Coatings	189
<i>K. Nakade, A. Ohmori, Y. Yamamoto, Osaka University, Osaka, Japan</i>	
Optimization of Axial Injection Conditions in a Supersonic Induction Plasma Torch: Application to SOFCs	195
<i>G. Renouard-Vallet, F. Gitzhofer, M. Boulos, CEA/CRTTP/SPCTS, Sherbrooke, Canada</i>	
<i>P. Fauchais, M. Vardelle, SPCTS, University of Limoges, Limoges, France</i>	
<i>L. Bianchi, CEA le Ripault, Monts, France</i>	
Methodology for Meeting Standards and Environmental Requirements in Thermal Spraying, Hardfacing and Sand Blasting	203
<i>M. Ducos, Consultant, Mornas, France</i>	
<i>D. Duchateau, Cetim, Senlis, France</i>	
Erosion Resistance of Arc Spray Composite Coatings at High Temperature on Boiler Tubes of Pulverized Coal Fired Power Station	211
<i>J. Hu, X. Chen, S. Ma, C. Li, Q. Liu, H. Jiang, Surface Engineering Institute of CMES, Beijing, China</i>	

Corrosion & Wear Protective Coatings

Assessing the Feasibility of Using Diamond as a Reinforced Phase in Metal Matrix Composite Coatings	217
<i>A. Neville, A. Richardson, J. Wilson, Heriot-Watt University, Edinburgh, Scotland</i>	
New Carbide Based Materials for HVOF Spraying	227
<i>S. Zimmermann, H. Keller, H.C. Starck GmbH, Laufenburg, Germany</i>	
<i>G. Schwier, H.C. Starck GmbH, Goslar, Germany</i>	
Advanced Oxide Ceramic Coatings for Applications Demanding High Wear Resistance	233
<i>K. Niemi, S. Rekola, Metso Paper Inc., Service, Jyväskylä, Finland</i>	
<i>P. Vuoristo, J. Laurila, M. Vippola, T. Mäntylä, Tampere University of Technology, Tampere, Finland</i>	
Development and Application of WC-Cr₃C₂-Ni Coating with High Impact Resistance	237
<i>Y. Itsukaichi, S. Osawa, Fujimi Incorporated, Kakamigahara, Gifu, Japan</i>	
Preparation and Characterization of Powders and Coatings Containing Solid Lubricants	243
<i>U. Männikkö, A. Määttä, P. Vuoristo, T. Mäntylä, Tampere University of Technology, Tampere, Finland</i>	
Properties of Plasma and D-Gun Sprayed Metal-Matrix-Composite (MMC) Coatings Based on Ceramic Hard Particle Reinforced Fe-, Ni-aluminide Matrix	249
<i>Fr.-W. Bach, Z. Babiak, T. Rothardt, Institute for Materials Science, Hannover, Germany</i>	
<i>B. Formanek, Silesian Technical University, Katowice, Poland</i>	
Ceramic Coating of Alloy 625 Using Controlled Atmosphere Plasma Spraying for Sea Water Corrosion Protection	255
<i>V. Guipont, J. Fauvarque, S. Beauvais, M. Jeandin, Ecole Nationale Supérieure des Mines de Paris, Evry, France</i>	
<i>H. Le Guyader, H. Lepresle, A. Grolleau, DCN – Direction des Constructions Navales, Cherbourg, France</i>	

The Influence of Matrix Phase Viscosity on the Plasma-Spray Deposition of Silicon-Nitride Composite Coatings	263
<i>Y. Bao, D. Gawne, South Bank University, London, United Kingdom</i>	
<i>T. Zhang, Kingston University, London, United Kingdom</i>	
Influence of Rare Earth Elements on the Corrosion Resistance of Fe-Cr-Ni Thermal Sprayed Coatings.....	269
<i>D. He, J. Jiang, Y. Yan, D. Xiong, Beijing Polytechnic University, Beijing, P.R. China</i>	
Process Temperature-Hardness-Wear Relationships for HVOF-Sprayed Nanostructured and Conventional Cermet Coatings	273
<i>B. Marple, R. Lima, National Research Council Canada, Boucherville, Quebec, Canada</i>	
A Parametric Study of an HVOF Process for the Deposition of Nanostructured WC-Co Coatings	283
<i>C. Bartuli, T. Valente, F. Cipri, University "La Sapienza" of Rome, Rome, Italy</i>	
<i>E. Bemporad, University "Roma TRE", Rome, Italy</i>	
<i>M. Tului, CSM, Rome, Italy</i>	
Abrasion and Sliding Wear of Nanostructured Ceramic Coatings	291
<i>L. Leblanc, PyroGenesis Inc., Montreal, Canada</i>	
Fatigue and Fracture Resistance of Nanostructured Composite System: Chrome Carbide - Hard Oxide Aluminum - Aluminum	301
<i>M. Kireitseu, Institute of Mechanics and Machine Reliability, Lesnoe, Minsk, Belarus</i>	
Abrasion Wear Behaviour of Plasma and HVOF Sprayed Al₂O₃-SiC Nanocomposite Coatings	311
<i>P. Dearnley, K. Panagopoulos, University of Leeds, Leeds, United Kingdom</i>	
Effect of Powder Composition on the Microstructure and Wear Properties of Sprayed Cast Iron Coatings.....	317
<i>M. Morks, M. Shoeib, Central Metallurgical Research and Development Institute, Cairo, Egypt</i>	
<i>Y. Tsunekawa, M. Okumiya, Toyota Technological Institute, Nagoya, Japan</i>	
Influence of Thermal Spray Process on the Corrosion Behavior of High-Density 316 Stainless Steel Coatings in Simulated Marine Environment	323
<i>S. Simard, Université du Québec à Rimouski, Rimouski, Québec, Canada</i>	
<i>B. Arsenault, Industrial Materials Institute, Boucherville, Québec, Canada</i>	
A New Spray Coating Process for Manufacture of Stainless Steel Clad Construction Steel with Resistance to Corrosion by De-icing Salts and Seawater.....	329
<i>P. Chesney, Spray Forming International, Cayce, South Carolina, USA</i>	
HVOF Reactive Spraying of Mechanically Alloyed Ni-Ti-C Powders	335
<i>A. Horlock, Z. Sadeghian, G. McCartney, P. Shipway, University of Nottingham, Nottingham, United Kingdom</i>	
Marine Exposure Tests of Thermal Sprayed Coatings in Japan.....	343
<i>S. Kuroda, J. Kawakita, National Institute for Materials Science, Tsukuba, Ibaraki, Japan</i>	
<i>M. Takemoto, Aoyama Gakuin University, Tokyo, Japan</i>	
<i>Thermal Spray Committee, Japan Association of Corrosion Control, Tokyo, Japan</i>	
Development of Dense Corrosion Resistant Coatings by an Improved HVOF Spraying Process	353
<i>J. Kawakita, T. Fukushima, S. Kuroda, T. Kodama, National Institute for Materials Science, Tsukuba, Ibaraki, Japan</i>	

Protection of Steel Components Against Marine Corrosion by Thermally Sprayed Anodic Coatings	361
<i>M. Schiefler, Federal Center for Technological Education - Curitiba, PR, Brazil</i>	
<i>F. Gärtner, J. Voyer, A. Kirsten, H. Kreye, University of the Federal Armed Forces - Hamburg, Germany</i>	
<i>A. Buschinelli, Federal University of Santa Catarina - Florianopolis, SC, Brazil</i>	
Development and Implementation of HVOF WC/Co/Cr Coating as Alternative to Electrolytic Hard Chrome Plate in Landing Gear Applications Using Natural Gas as Fuel.....	371
<i>D. Lee, Stellite Coatings, Goshen, Indiana, USA</i>	
<i>R. Eybel, R. Evans, Messier-Dowty, Ajax, Ontario, Canada</i>	
Fatigue and Deformations of HVOF Sprayed WC-Co Coatings vs. Hard Chrome Plating.....	377
<i>A. Ibrahim, Farmingdale State University, Farmingdale, New York, USA</i>	
<i>C. Berndt, State University of NY at Stony Brook, Stony Brook, New York, USA</i>	
Optimization of Heat Transferring Components under Severe Wear Stress Conditions	381
<i>B. Wielage, A. Wank, G. Reisel, Chemnitz University of Technology, Chemnitz, Germany</i>	
<i>U. Gross, G. Barth, Freiberg University of Mining and Technology</i>	
Studies of Cavitation Resistant Thermally Sprayed and Welded Coatings	389
<i>C. Lima, UNIMEP- Methodist University of Piracicaba, Santa Bárbara d'Oeste, São Paulo, Brazil</i>	
<i>P. Marques, UFMG - Federal University of Minas Gerais, Belo Horizonte, MG, Brazil</i>	
Corrosion of WC-Co-Cr Cermet Coatings Using In-Situ Atomic Force Microscopy	395
<i>V. Souza, A. Neville, Heriot-Watt University, Edinburgh, Scotland, United Kingdom</i>	
Erosion Behavior of WC-10Co-4Cr HVOF Coatings	405
<i>J. Legoux, B. Arsenaault, NRC Canada - Industrial Materials Institute, Boucheville, Québec, Canada</i>	
<i>H. Hawthorne, NRC Canada- Innovation Center, Vancouver, British Columbia</i>	
<i>J. Immarigeon, NRC Canada-Institute for Aerospace Research, Ottawa, Ontario, Canada</i>	
Surface Changes of Several Thermal Spray Coatings Abraded by a TiO₂ Slurry	411
<i>A. Stavros, Praxair Surface Technologies, Inc., Indianapolis, Indiana, USA</i>	
Erosion and Abrasion Resistance of Boride and Carbide-Based Weld Overlays	421
<i>F. Lapointe, S. Dallaire, Synthesarc, Boucherville, Quebec, Canada</i>	
Tribological Testing of High Velocity Oxy Fuel (HVOF) Sprayed Composite Cermet Coatings Using Ball on Disk Configuration.....	427
<i>P. K. Aw, B. H. Tan, Singapore Institute of Manufacturing Technology, Singapore</i>	
Relation Between Abrasive Wear and Microstructure of HVOF Cermet Coatings	435
<i>C.-J. Li, Y.-Y. Wang, G.-C. Ji, Xi'an Jiaotong University, Xi'an, Shaanxi, P.R. China</i>	
<i>A. Ohmori, Osaka University, Ibaraki, Osaka, Japan</i>	
Design of HVOF Sprayed Tungsten Carbide Coatings for Best Sliding Wear and Fatigue Life Characteristics	443
<i>R. Isaac, J. Savarimuthu, J. Shadley, E. Rybicki, The University of Tulsa, Tulsa, Oklahoma, USA</i>	
<i>W. Emery, W. Kalivas, Southwest Aeroservice, Inc., Tulsa, Oklahoma, USA</i>	
Plasma Sprayed Stainless Steel Coatings Doped with Graphite Particles: Study of Their Dry Friction Coefficient Against 100C6 Steel Using a Pin on Disk Test.....	449
<i>A. Harir, H. Ageorges, A. Grimaud, P. Fauchais, University of Limoges, France</i>	
<i>F. Platon, ENSCI, Limoges, France</i>	

Plasma Sprayed Nanostructured Zirconia Coatings for Wear Resistance	455
<i>C. Ding, H. Chen, X. Liu, Y. Zeng, Shanghai Institute of Ceramics, Shanghai, China</i>	
Sliding Wear Evaluation of Hot Isostatically Pressed (HIPed) Thermal Spray Cermet Coatings	459
<i>V. Stoica, R. Ahmed, Heriot-Watt University, Edinburgh, United Kingdom</i>	
<i>T. Itsukaichi, Fujimi Incorporated, Kakamigahara, Japan</i>	
<i>S. Tobe, Ashikaga Institute of Technology, Sliding Wear Evaluation, Ashikagashi, Japan</i>	
<i>M. Escribano, Stuttgart University, Stuttgart, Germany</i>	
Effect of Post-Treatment on the Corrosion Behaviour of HVOF-Stellite 6 Coatings.....	467
<i>U. Malayoglu, A. Neville, Heriot-Watt University, Edinburgh, Scotland</i>	
<i>D. De Wet, Deloro Stellite, Swindon, England</i>	
Formation of Intermetallic Phases by Laser Alloying of Thermally Sprayed Ti and Al Coatings for Enhanced Wear Resistance of Lightweight Materials	475
<i>J. Wilden, H. Frank, Technical University, Ilmenau, Germany</i>	
The Effect of Chlorine on Degradation Mechanisms of Thermal Sprayed Coatings at Elevated Temperatures	485
<i>M. Uusitalo, P. Vuoristo, T. Mäntylä, Tampere University of Technology, Finland</i>	
<i>L. Berger, Fraunhofer Institute of Ceramic Technologies and Sintered Materials, Dresden, Germany</i>	
<i>R. Backman, Åbo Akademi University, Finland</i>	
Steam Oxidation Resistance of HVOF Thermal Sprayed Ni-Cr Coatings.....	495
<i>T. Sundararajan, S. Kuroda, T. Itagaki, F. Abe, National Institute for Materials Science, Sengen, Tsukuba, Japan</i>	
Effect of Thermal Sprayed Al on the Steam Oxidation Resistance of 9Cr-1Mo Steel	503
<i>T. Sundararajan, S. Kuroda, T. Itagaki, F. Abe, National Institute for Materials Science, Sengen, Tsukuba, Japan</i>	
The Use of Tungsten Carbide Materials for Oils and Wear Applications	509
<i>S. Chiovelli, M. Anderson, Syncrude Canada Ltd, Edmonton, Alberta, Canada</i>	
<i>R. Llewellyn, National Research Council of Canada, Vancouver, British Columbia, Canada</i>	
Evaluation of Modern HVOF Systems Concerning the Application of Hot Corrosion Protective Coatings.....	519
<i>F. Bach, L. Engl, Institute of Materials Science, Hannover, Germany</i>	
<i>C. Bach, Research Center for Surface Technology and Innovation Service, Witten, Germany</i>	
<i>E. Lugscheider, M. Parco, Materials Science Institute, Aachen, Germany</i>	
<i>T. Duda, ALSTOM Power Switzerland Ltd., Baden, Switzerland</i>	
Low Friction Metallic Coatings for Reducing Railroad Squeal.....	529
<i>W. Wei, WEI Consulting, Enschede, The Netherlands</i>	
<i>P.A.A. Kootwijk, Railinfrabeheer B.V., Utrecht, The Netherlands</i>	
Activated Combustion HVOF Coatings for Protection Against Wear and High Temperature Corrosion ...	535
<i>A. Verstak, V. Baranovski, UniqueCoat Technologies, Ashland, Virginia, USA</i>	
Microstructure and Wear Performance of Spray and Fused NiCrBSiC/WC Composite Coatings.....	543
<i>H. Kim, S.Y. Hwang, RIST, Nagoya, Japan</i>	
<i>C.H. Lee, Hanyang University, Seoul, Korea</i>	
New Thermal Spray Coating Technology for Corrosion/Erosion Protection.....	549
<i>B. Ferree, Watson Grinding & Mfg., Houston, Texas, USA</i>	

Equipment and Processes

- Microplasma Spraying of Bioceramic Coatings**.....553
V. Bobric, S. Vojnarovich, N. Ulianchich, J. Jansen, J.G. Wolke, Y. Borisov, PWI, NASU, Kyiv, Ukraine
- Improved Heat Transfer by RF Plasma Produced Structured Surfaces**559
E. Bouyer, R. Henne, D. Schäfer, H. Müller-Steinhagen, German Aerospace Center, Stuttgart, Germany
H. Asano, Kobe University, Kobe, Japan
- Characterization of Coatings Deposited by Laser-Assisted Atmospheric Plasma Spraying**567
L. Berger, R. Zieris, S. Nowotny, L. Haubold, E. Beyer, Fraunhofer Institute for Material and Beam Technology, Dresden, Germany
- Modified Nozzle for the Atmospheric Plasma Spraying**.....573
A. Schwenk, G. Nutsch, Technische Universität, Ilmenau, Germany
H. Gruner, Medicoat AG, Switzerland
- Characterization of LPPS Processes Under Various Spray Conditions for Potential Applications**.....581
A. Refke, G. Barbezat, Sulzer Metco AG, Wohlen, Switzerland
C. Hollenstein, J. Dorier, M. Gindrat, EPFL/CRPP, Lausanne, Switzerland
- Low Pressure Wire Arc and Vacuum Plasma Spraying of NiTi Shape Memory Alloys**589
A. Sickinger, ProMet Technologies Inc., Laguna Hills, California, USA
L. Zysset, S. Siegmann, Swiss Federal Laboratories for Materials Testing and Research, EMPA Thun, Switzerland
K. Halter, University of Applied Sciences, BERNE/Burgdorf, Switzerland
- Effect of Chamber Pressure and Spray Distance on the Plasma Sprayed Alumina Deposition**597
S. Sodeoka, M. Suzuki, T. Inoue, National Institute of Advanced Industrial Science and Technology, Tsukuba, Ibaraki, Japan
- On Vacuum Plasma Spray Forming of Ti-6Al-4V**603
L. Leblanc, P. Tsantrizos, PyroGenesis Inc., Montreal, Canada
H. Salimijazi, T. Coyle, J. Mostaghimi, University of Toronto, Toronto, Canada
- Microstructural Formation of Vacuum Plasma Sprayed Ti-6Al-4V Alloy**.....611
H. Salimijazi, T. Coyle, J. Mostaghimi, University of Toronto, Toronto, Ontario, Canada
L. Leblanc, P. Tsantrizos, PyroGenesis Inc., Montreal, Quebec, Canada
- Effect of Aluminum Phosphate Sealing on the Elastic Properties of Plasma Sprayed Ceramic Coatings**.....617
J. Dubsky, P. Chráska, Institute of Plasma Physics ASCR, Prague, Czech Republic
S. Ahmaniemi, M. Vippola, P. Vuoristo, T. Mäntylä, Tampere University of Technology, Institute of Materials Science, Tampere, Finland
- Investigation of the Influence of Post-Treatments on the Mechanical Properties of Coated Aluminium Foams**.....623
M. Maurer, L. Zhao, E. Lugscheider, Materials Science Institute, RWTH Aachen, Germany
- Integrated Machine Tool for Laser Beam Cladding and Freeforming**.....629
S. Nowotny, S. Scharek, T. Naumann, Fraunhofer Institute for Material and Beam Technology, Dresden, Germany

Determination of the Moving Velocity of Preheating Gun During Preheating/Spraying/Cooling Process by a Function Specification Method	633
<i>H. Liao, H. Deng, C. Verdy, C. Coddet, LERMPS, Belfort Cedex, France</i>	
Influence of Carrier Gas Flow and Liquid Injection in the Plasma Jet on Plasma Characteristics During the Atmospheric Plasma Spray Process	641
<i>J. Döring, R. Vaßen, D. Stöver, FZ-Jülich GmbH, Jülich, Germany</i>	
Plasma Spraying with Low Power Consumption and High Efficiency	649
<i>Y. Gao, Institute of Materials and Technology, Dalian Maritime University, China</i>	
High-Pressure, Non-Pulsing Powder Feeder for Cold Spray and Thermal Spray Processes	653
<i>T. Roemer, D. Beatty, A. Mayer, A. Papyrin, R. Blose, R. Nichols, Ktech Corporation, Albuquerque, New Mexico, USA</i>	
High Velocity Continuous Combustion: A Review of the Technology and Performance History	657
<i>H. Hill, AmStar International LLC, Houston, Texas, USA</i>	

Feedstocks and Novel Materials

Plasma Spray Elaboration of Finely Structured YSZ Thin Coating by Liquid Suspension Injection	661
<i>C. Delbos, J. Fazilleau, J. Coudert, P. Fauchais, SPCTS, University of Limoges, Limoges, France</i>	
<i>L. Bianchi, K. Wittmann-Ténèze, Commissariat à l'Energie Atomique, Le ripault, Monts, France</i>	
Plasma Sprayed Coatings Using Different Nanosize Alumina Powders	671
<i>Y. Zeng, C. Ding, Shanghai Institute of Ceramics, Shanghai, China</i>	
<i>S. Lee, Sunmoon University, Asan, South Korea</i>	
Preparation of TiO₂ Photocatalyst by Thermal Spraying with Liquid Feedstock	675
<i>G.-J. Yang, C.-J. Li, F. Han, S.-F. Mao, Xi'an Jiaotong University, Xi'an, Shaanxi, P.R. China</i>	
New Composite Coatings on the Base of Recycled Hardmetals	681
<i>S. Zimakov, P. Kulu, R. Tarbe, Tallinn Technical University, Tallinn, Estonia</i>	
Plasma Spraying of a Perovskite Suspension for SOFC Cathodes	687
<i>C. Monterrubio-Badillo, H. Ageorges, T. Chartier, J. F. Coudert, P. Fauchais, University of Limoges, Limoges, France</i>	
Study on Finishing Wear Resistant Thermally Sprayed Coatings: Influence of Feed Stock Material, Spraying Parameters and Machining Parameters	693
<i>J. Wilden, D. Szczesny, S. Jahn, Technical University, Ilmenau, Germany</i>	
Study on Alumina-based Nano Composite Coating Prepared by Plasma Spray	701
<i>M. Suzuki, S. Sodeoka, T. Inoue, National Institute of Advanced Industrial Science and Technology, Ibaraki, Japan</i>	
Stainless Steel Coatings Alumina Reinforced by Plasma Spraying Mechanofused Particles	707
<i>R. Cuenca-Alvarez, H. Ageorges, P. Fauchais, University of Limoges, Limoges, France</i>	
Peculiarities of Structure of Quasicrystalline Al-Cu-Fe System Coatings Produced by Thermal Spraying Methods	713
<i>A. Borisova, Y. Borisov, M. Panko, L. Adeeva, M. Kolomytsev, A. Shakhraj, V. Sladkova, PWI, NASU, Kyiv, Ukraine</i>	

Sialon Coating from Sintered Mixtures of Silicon Nitride and Oxides.....	719
<i>B. Seong, S. Hwang, J. Park, Research Institute of Industrial Science and Technology, Pohang, Korea (S)</i>	
Standardization in Quality Control of Thermal Spray Coatings	725
<i>M. Van Wonderen, KLM Royal Dutch Airlines, Amsterdam, The Netherlands</i>	
<i>J. Sauer, Sauer Engineering, Cincinnati, Ohio, USA</i>	
“RECAST” - The Repair of Airfoils When Welding is Unacceptable.....	731
<i>J. Burke, Flight Support Inc., North Haven, Connecticut, USA</i>	
New Abradable Seals for Industrial Gas Turbines.....	735
<i>K. Hajmrle, P. Fiala, A. Chilkowich, L. Shiembob, Westaim Ambeon, Fort Saskatchewan, Alberta, Canada</i>	
Oxidation Behavior of Electroplated MCrAlY Coatings.....	741
<i>A. Khan, T. Duda, Alstom (Switzerland) Ltd., Baden, Switzerland</i>	
<i>A. Taylor, P. Moore, P. Rutter, J. Foster, Praxair Surface Technologies, Weston Super-Mare, Somerset, England</i>	
On the Stripping of Turbine Blades and Vanes: Mechanisms and Performances of Chemical Stripping for the Removal of NiCrAlY Thermal Spray Coatings	745
<i>A. Scrivani, M. Soranzo, University of Parma, Parma, Italy</i>	
<i>G. Rizzi, Turbocoating SpA, Parma, Italy</i>	
<i>U. Bardi, L. Carafiello, University of Florence, Florence, Italy</i>	

HVOF

HVOF Coatings of Ball-Milled Al₂O₃/NiCr Dispersion-Strengthened Powders.....	749
<i>E. Lugscheider, J. Zwick, Materials Science Institute, Aachen University of Technology, Aachen, Germany</i>	
<i>H. Zhang, EWM Hightec Welding GmbH, Mündersbach, Germany</i>	
Key Factors for Dense Copper Coating by HVOF Spraying	755
<i>K. Isoyama, H. Yumoto, Tokyo University of Science, Noda, Japan</i>	
<i>J. Kawakita, S. Kuroda, National Institute for Material Science, Tsukuba, Japan</i>	
Evaluation of HVOF Coatings for Wear Applications	763
<i>C. Lima, UNIMEP- Methodist University of Piracicaba, São Paulo, Brazil</i>	
<i>F. Camargo, Ogramac - Commercy and Industry Ltd., S. Antonio de Posse, São Paulo, Brazil</i>	
Development of Light Metal Matrix Composite Coatings Using High Velocity Thermal Spray Processes	769
<i>F. Bach, L. Engl, Institute of Materials Science, Hannover, Germany</i>	
<i>L. Josefiak, Institute of Materials Engineering, Dortmund, Germany</i>	
Modelling and Design of an Attachment to the HVOF Gun	779
<i>L. Pershin, A. Dolatabadi, J. Mostaghimi, University of Toronto, Toronto, Ontario, Canada</i>	
High Velocity Oxygen/Air Fuel Spray	789
<i>B. Zha, H. Wang, X. Su, Xi'an Research Institute of Hi-Tech, Xi'an, China</i>	

Microstructure and Properties of HVOF-Sprayed TiC-Based Coatings.....	793
<i>L. Berger, Fraunhofer Institute for Material and Beam Technology, Dresden, Germany</i>	
<i>S. Zimmermann, H. Keller, G. Schwier, R. Scholl, H.C.Starck GmbH, Goslar and Laufenburg, Germany</i>	
<i>S. Thiele, M. Nebelung, Fraunhofer Institute of Ceramic Technologies and Sintered Materials, Dresden, Germany</i>	
<i>R. Enzl, Skoda Vyzkum s.r.o., Plzen , Czech Republic</i>	
Acoustic Emission as a Tool for Characterising HVOF-Sprayed WC-Co Coatings	801
<i>L. Driver, P. Shipway, G. McCartney, University of Nottingham, Nottingham, United Kingdom</i>	
<i>L. Donohue, D. Rickerby, Rolls Royce plc, Derby, United Kingdom</i>	
HVOF Coating Characterization by Acoustic Emission Using Four- Point Bending Test.....	809
<i>S. Bouaricha, J. Legoux, P. Marcoux, CNRC, Boucherville, Québec, Canada</i>	
Influence of Powder Size and Strength on HVOF Spraying - Mapping the Onset of Spitting	819
<i>T. Itsukaichi, S. Osawa, Fujimi Inc., Kakamigahara, Gifu, Japan</i>	
<i>R. Ahmed, Heriot-Watt University, School of EPS, Riccarton, Edinburgh, United Kingdom</i>	
Development of HVOF Sprayed Aluminium Alloy Engine Bearings	825
<i>A. Sturgeon, C. Reignier, TWI Ltd, Cambridge, United Kingdom</i>	
<i>I. Laing, C. Perrin, Dana - Glacier Vandervell, Rugby, Warwickshire, United Kingdom</i>	
Mechanical Properties and Microstructure of HVOF Sprayed Co and Ni Alloy Coatings	829
<i>D. Zhang, S. Harris, G. McCartney, University of Nottingham, Nottingham, United Kingdom</i>	
Structure and Property of WC-17Co Coatings Sprayed by HVO/AF	837
<i>B. Zha, H. Wang, X. Su, Xi'an Research Institute of Hi-Tech, Xi'an, China</i>	
Property Evaluation of HVOF-Sprayed Magnetic Thick Films	841
<i>X. Ma, S. Ge, T. Zhang, Y. Zhang, Inframat[®] Corporation, Farmington, Connecticut, USA</i>	

Volume 2

Science and Applications of Thermal Spray

Coating Formation by Impact of Molten Metal Droplets with Uniform Size and Velocity.....	847
<i>R. Dhiman, S. Chandra, University of Toronto, Toronto, Ontario, Canada</i>	
Splat Profile of Impinging Droplets on Rough Substrates.....	857
<i>S. Amada, I. Imakawa, Gunma University, Kiryu, Gunma, Japan</i>	
<i>S. Aoki, Hitach Densen Co. Ltd.</i>	
Experimental Correlation Between Flattening Degree and Reynolds Number of Spray Particles	863
<i>C.-J. Li, Xi'an Jiaotong University, Xi'an, Shaanxi, P.R.China</i>	
<i>H.-L. Liao, P. Gougeon, G. Montavon, C. Coddet, LERMPS-UTBM, Belfort, France</i>	
Evaluation of Sn and Al₂O₃ Splats by Fractal Geometry	871
<i>R. Hikari, Hitachi Chemical Co. Ltd, Tokyo, Japan</i>	
<i>S. Amada, Gunma University, Gunma, Japan</i>	
<i>S. Uematsu, National Maritime Safety Institute, Tokyo, Japan</i>	

Effect of Reynolds Number of Molten Spray Particles on Splat Formation in Plasma Spraying	875
<i>C.-J. Li, Xi'an Jiaotong University, Xi'an, Shaanxi, P.R. China</i>	
<i>H.-L. Liao, P. Gougeon, G. Montavon, C. Coddet, LERMPS-UTBM, Belfort, France</i>	
Influence of Surface Laser Cleaning Combined with Substrate Preheating on the Splat Morphology	883
<i>H. Liao, A. Gammoudi, S. Costil, C. Coddet, LERMPS-UTBM, Belfort, France</i>	
Influence of Substrate Temperature on Formation of Micrometric Splats Obtained by Plasma Spraying Liquid Suspension	889
<i>J. Fazilleau, C. Delbos, M. Violier, J. Coudert, P. Fauchais, Laboratoire Science des Procédés Céramiques et Traitements de Surface, Limoges, France</i>	
<i>L. Bianchi, K. Wittmann-Teneze, Commissariat à l'Energie Atomique, Le ripault, Monts, France</i>	
Modeling of Coating Formation and Heat Flux to Substrate by Particles and Plasma Jet in Plasma Spraying	895
<i>G. Mariaux, E. Legros, A. Vardelle, University of Limoges, Limoges, France</i>	
Partially Melted Particle and Its Splat Morphology	905
<i>H. Zhang, H. Xiong, L. Zheng, A. Vaidya, L. Li State University of NY at Stony Brook, Stony Brook, New York, USA</i>	
Synthesis of BCN Coatings in Thermal Plasma Jets	913
<i>A. Wank, B. Wielage, Chemnitz University of Technology, Chemnitz, Germany</i>	
Research on Fluid Properties of Low Energy, High Efficiency and Non-transferred Arc Plasma Jet	921
<i>Z. Yan, L. An, Y. Gao, Dalian Maritime University, Dalian, Liaoning, China</i>	
<i>X. Huang, Chinese Academy of Agricultural Mechanization Sciences, Beijing, China</i>	
Modeling Residual Stress Build-up in the Coating Microstructure	927
<i>R. Ghafouri-Azar, S. Chandra, J. Mostaghimi, University of Toronto, Toronto, Ontario, Canada</i>	
Model of Thermal Spraying Using a Monte-Carlo Approach	931
<i>T. Zhang, B. Liu, Kingston University, London, United Kingdom</i>	
<i>Y. Bao, D. Gawne, South Bank University, London, United Kingdom</i>	
Neural Networks, Design of Experiments and Other Optimization Methodologies to Quantify Parameter Dependence of Atmospheric Plasma Spraying	939
<i>G. Montavon, S. Guessasma, C. Coddet, LERMPS-UTBM, Belfort Cedex, France</i>	
Modeling of the Substrate Temperature Evolution During the APS Thermal Spray Process	949
<i>R. Bolot, J. Li, R. Bonnet, C. Mateus, C. Coddet, LERMPS-UTBM, Belfort, France</i>	
Plasma Spraying Flow Modeling: Generation of the Plasma Column and Turbulent Flow into a Dense Atmosphere	955
<i>D. Guenadou, E. Meillot, Commissariat à l'Energie Atomique, Le ripault, Monts, France</i>	
On the Study of the Thermal Fluxes Transferred during the HEATCOOL® Process	965
<i>R. Bolot, H. Deng, H. Liao, C. Coddet, LERMPS-UTBM, Belfort, France</i>	
On the Use of SYSWELD and PHOENICS for the Computation of Heat Transfer in a Substrate Exposed to an Impinging Plasma Jet	971
<i>R. Bolot, J. Li, H. Liao, C. Coddet, LERMPS-UTBM, Belfort, France</i>	

Application of CFD for Wire-Arc Nozzle Geometry Improvement	977
<i>I. Gedzevicius, R. Bolot, H. Liao, C. Coddet, LERMPS-UTBM, Belfort, France</i>	
<i>A. Valiulis, Vilnius Gediminas Technical University, Vilnius, LTU</i>	
Conjugated Gradient Method for Estimating Inversely the Flux Distribution of Cooling Jets.....	981
<i>H. Liao, H. Deng, C. Coddet, LERMPS, Belfort Cedex, France</i>	
In-Flight Oxidation of Metallic Particles in Plasma Spraying	985
<i>A. A. Syed, A. Denoirjean, P. Denoirjean, J. C. Labbe, P. Fauchais, SPCTS, University of Limoges, Limoges, France.</i>	
Turbulence Modeling of Inductively Coupled Plasma Flows	993
<i>S. Xue, P. Proulx, M. Boulos, Université de Sherbrooke, Quebec, Canada</i>	
Computer Modelling of the Plasma Spraying Process.....	1001
<i>Y. Borisov, I. Krivtsun, A. Muzhichenko, The E.O. Paton Electric Welding Institute, NASU, Kyiv, Ukraine</i>	
Diagnostic of Supersonic High Frequency (HF) Plasma Flow	1011
<i>M. Boulos, D. Gravelle, V. Léveillé, Université de Sherbrooke, Quebec, Canada</i>	
Modeling of Transport and Evaporation of Liquid Droplets Sprayed into RF-ICPs	1017
<i>Y. Shan, J. Mostaghimi, University of Toronto, Ontario, Canada</i>	
Primary Breakup of Metal in the Wire Arc Spray Process	1023
<i>N. Hussary, J. Heberlein, University of Minnesota, Minneapolis, Minnesota, USA</i>	
Oxidation of Ni-Based Alloys Sprayed by a Water-Stabilized Plasma Gun (WSP®)	1033
<i>K. Volenik, P. Chráska, J. Dubský, Institute of Plasma Physics ASCR, Prague, Czech Republic</i>	
<i>J. Had, J. Leitner, Institute of Chemical Technology, Prague, Czech Republic</i>	
<i>O. Schneeweiss, Institute of Physics of Materials, Brno, Czech Republic</i>	
Substrate Melting During Thermal Spray Splat Quenching: Case Study for Molybdenum Droplets on Various Substrates	1041
<i>L. Li, X. Wang, A. Vaidya, G. Wei, H. Zhang, S. Sampath, State University of NY at Stony Brook, Stony Brook, New York, USA</i>	
Dependence of Thermal Sprayed Particle/Substrate Interface Microstructure on Substrate Temperature	1047
<i>M. Fukumoto, K. Hamada, M. Shiiba, Toyohashi University of Technology, Toyohashi, Aichi, Japan</i>	
Insights to Spraying Conditions, Microstructure and Properties and Their Statistical Correlation for Different Thermal Spraying Processes Using Complementary Characterization Methods.....	1053
<i>N. Margadant, S. Siegmann, Swiss Federal Laboratories for Materials Testing and Research, Thun, Switzerland</i>	
<i>T. Keller, W. Wagner, Paul Scherrer Institute, Villigen, Switzerland</i>	
<i>A. Kulkarni, Center for Thermal Spray Research, State University of NY at Stony Brook, Stony Brook, New York, USA</i>	
Polymerlike C:H Thin Film Coating of Nanopowders in Capacitively Coupled RF Discharge.....	1063
<i>M. Boulos, F. Gitzhofer, A. Kouprine, Université de Sherbrooke, Québec, Canada</i>	
<i>A. Fridman, University of Illinois at Chicago, Chicago, Illinois, USA</i>	

Field Electron Emission from Surface of Plasma Sprayed and Laser Engraved Al₂O₃+13TiO₂ and Al₂O₃+40TiO₂ Coatings 1069
L. Pawlowski, M. Rivenet, R. Vannier, Laboratoire de Cristalochimie et Physicochimie du Solide, Villeneuve d'Ascq, France
Z. Znamirowski, W. Czarczynski, Faculty of Microsystem Electronics and Photonics, Wroclaw, Poland
F. Campana, J. Janssen, Advanced Coating, Liège, Belgium

Powder Densification and Spheroidization Using Induction Plasma Technology 1075
X. Fan, J. Guo, N. Dignard, C. Normand, Tekna Plasma Systems Inc., Sherbrooke, Quebec, Canada

Effect of Particle Size and Spray Distance on the Features of Plasma Sprayed Cast Iron 1081
M. Morks, M. Shoeib, Central Metallurgical Research and Development Institute, Cairo, Egypt
Y. Tsunekawa, M. Okumiya, Toyota Technological Institute, Nagoya, Japan

Effect of the Chamber Pressure on the Structure of a Plasma Jet 1087
R. Bolot, D. Klein, C. Coddet, LERMPS-UTBM, Belfort, France

Sensors & Controls

Control of Particle Temperature, Velocity, and Trajectory in the Thermal Spray Process 1093
J.R. Fincke, W. David Swank, R.L. Bewley, D.C. Haggard, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho, USA
M. Gevelber, D. Wroblewski, Boston University, Boston, Massachusetts, USA

Sensitivity Study of Four On-Line Diagnostic Systems for Plasma Spraying 1101
P. Nylén, J. Lemaitre, J. Wigren, Volvo Aero Corporation, Trollhättan, Sweden

Particle Temperature and Velocity Measurements by Two-Wavelength Streak Imaging 1107
J. Craig, R. Parker, D. Lee, T. Wakeman, Stratonics, Inc, Laguna Hills, California, USA
J. Heberlein, D. Guru, University of Minnesota, Minneapolis, Minnesota, USA

In-Flight Particle Imaging in Thermal Spraying with Diode Laser Illumination 1113
J. Larjo, E. Hämäläinen, N. Kriikka, Oseir Ltd., Tampere, Finland

Simple Self-Selective Method of Velocity Measurement for Particles in Spray Coating 1117
M. Lebedev, J. Akedo, National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan

Real-Time Control for Plasma Spray: Production Issues and Distribution Implications 1121
M. Gevelber, C. Cui, B. Vattiat, D. Wroblewski, Boston University, Brookline, Massachusetts, USA
J. Fincke, D. Swank, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho, USA

Integration of a Feedback Controller into a Standard In-Flight Particle Sensor 1131
J. Blain, L. Pouliot, F. Nadeau, Tecnar Automation Ltd, St-Bruno, Quebec, Canada
J. Bisson, G. Vaudreuil, C. Moreau, National Research Council Canada, Boucherville, Quebec, Canada

Correlations Between Processing Parameters, Coatings Properties and In-Flight Particle Characteristics 1139
G. Montavon, S. Guessasma, C. Coddet, LERMPS-UTBM, Belfort Cedex, France

A Numerical Study of the Sources of Variation in In-Flight Particle Characteristics in Atmospheric Plasma Spraying	1149
<i>M. Friis, P. Nylén, University of Trollhättan/Uddevalla, Trollhättan, Sweden</i>	
Modern Gas Supply Systems for Thermal Spraying	1157
<i>W. Kroemmer, P. Heinrich, Linde AG, Gas and Engineering, Unterschleissheim</i> <i>D. Park, Linde Gas, USA</i>	
How to Improve the Reliability and Reproducibility of Plasma Sprayed Coatings	1165
<i>P. Fauchais, M. Vardelle, University of Limoges, France</i>	
Investigations of In-Flight Particle Characteristics through DPV Measurements and Correlation with Impact Analysis and Coating Properties	1175
<i>M.-P. Planche, A. Lakat, H. Liao, C. Coddet, LERMPS-UTBM, Belfort, France</i>	
Particle Temperature and Velocity Characterization in Spray Tooling Process by Thermal Imaging Technique	1183
<i>P. Mohanty, University of Michigan, Dearborn, Michigan, USA</i> <i>R. Allor, Ford Motor Company, Dearborn, Michigan, USA</i> <i>P. Lechowicz, R. Parker, J. Craig, Stratonics Inc., Laguna Hills, California, USA</i>	
Influences on the Kinematics of the APS-Process Investigated by Means of Particle Image Velocimetry	1191
<i>F. Bach, K. Möhwald, B. Dröbner, J. Prehm, T. Rothardt, Institute for Materials Science, Hannover, Germany</i> <i>T. Copitzky, Institute of Materials Engineering, Dortmund, Germany</i>	
Particle Properties Tailor Coating Microstructure, Porosity and Phase Composition	1197
<i>J. Döring, R. Vaßen, D. Stöver, FZ-Jülich GmbH, Jülich, Germany</i> <i>R. Castro, Los Alamos National Laboratory, Los Alamos, New Mexico, USA</i>	
The Influence of Spray Parameters on Ni20Cr Coating Properties Using On-line Optimization Process	1205
<i>J.R Miguel, J.M Guilemany, J. Nin, J. Navarro, M. Gaona, Thermal Spray Centre, Barcelona, Spain</i>	
On-Line Monitoring Assisted Spray Process Optimization of Thermal Barrier Coatings	1213
<i>A. Tricoire, E. Legros, A. Vardelle, ENSIL, SPCTS, University of Limoges, Limoges, France</i> <i>S. Ahmaniemi, P. Vuoristo, T. Mäntylä, Tampere University of Technology, Tampere, Finland</i>	
Diagnostics at Thermal Coating Processes - Research Results of the DFG-Founded Project	1221
<i>Fr.-W. Bach, J. Prehm, B. Droessler, Hanover, Germany</i> <i>R. Henne, E. Bouyer, Stuttgart, Germany</i> <i>K. Landes, T. Streibl, S. Zimmermann, Munich, Germany</i> <i>E. Lugscheider, F. Ernst, A. Fischer, K. Seemann, Aachen, Germany</i> <i>T. Copitzky, Dortmund, Germany</i>	
Influence of Secondary Hydrogen on the Microstructure of Plasma-Sprayed Yttria-Stabilized Zirconia Coatings	1229
<i>J. Bisson, C. Moreau, National Research Council Canada, Québec, Canada</i> <i>M. Dorfman, C. Dambra, J. Mallon, Sulzer Metco, Westbury, New York, USA</i>	
Production Experience of On-Line Diagnostic Systems in Plasma- and Flame Spraying	1237
<i>J. Wigren, P. Nylén, Volvo Aero Corporation, Trollhättan, Sweden</i>	

Industrial On-Line Control of HVOF Spray Process Using SDC System.....	1243
<i>C. Bossoutrot, F. Braillard, SNECMA Services, Chatellerault, France</i>	
<i>S. Bansard, M. Vardelle, P. Fauchais, SPCTS, University of Limoges, France</i>	
On-line Optical Diagnostics of a Rotating Internal Diameter Plasma Spray Gun Used for Coating of Cylinder Bores in Automotive Industry	1249
<i>E. Hämäläinen, N. Kriikka, Oseir Oy, Tampere, Finland</i>	
<i>G. Barbezat, Sulzer Metco AG, Wohlen, Switzerland</i>	
Experimental Study of Substrate Thermal Conditions at APS and HVOF.....	1255
<i>A. Zagorski, F. Szuecs, ALSTOM, Baden, Switzerland</i>	
<i>V. Belashchenko, TSD, Concord, New Hampshire, USA</i>	
<i>S. Siegmann, N. Margadant, EMPA Switzerland</i>	
<i>A. Ivanov, Praxair Surface Technologies, Indianapolis, Indiana, USA</i>	
Fluid Dynamic Effects on Plasma Torch Anode Erosion.....	1261
<i>J. Heberlein, X. Sun, University of Minnesota, Minneapolis, Minnesota, USA</i>	
DC Plasma Diagnostics for Improvement of Plasma Spraying Process Under Soft Vacuum Conditions	1269
<i>V. Rat, E. Bouyer, R. Henne, German Aerospace Center, Stuttgart, Germany</i>	
<i>W. Mayr, Munich University of Applied Sciences, Munich, Germany</i>	
Examination of the Dry Ice Removal Process for Thermal Sprayed Coatings by Particle Image Velocimetry.....	1279
<i>C. Redeker, F. Bach, University of Hanover, Germany</i>	
<i>T. Copitzky, University of Dortmund, Germany</i>	

Testing and Characterization

Chemical Reactions between Hydroxyapatite (HA) and Titania during HVOF Spraying and In Vitro Response of the HA/Titania Composite Coating.....	1285
<i>H. Li, K.A. Khor, P. Cheang, Nanyang Technological University, Singapore, Republic of Singapore</i>	
Microstructure and Properties of Micro-Plasma Sprayed Cu Coating	1291
<i>C.-J. Li, B. Sun, M. Wang, F. Han, T. Wu, Xi'an Jiaotong University, Xi'an, Shaanxi, P.R. China</i>	
Residual Stress Analysis in Thermally Sprayed Layer Composites, Using the Microhole Milling and Drilling Method.....	1297
<i>M. Buchmann, Federal-Mogul Friedberg GmbH, Stuttgart, Germany</i>	
<i>M. Escribano Perez, R. Gadow, Institute for Manufacturing Technologies of Ceramic Components and Composites, Friedberg, Germany</i>	
Highly Porous Deposits of Cr₂O₃ Prepared by Plasma Co-spraying of Cr₂O₃ and Al	1307
<i>K. Neufuss, B. Kolman, P. Ctibor, P. Chráska, Institute of Plasma Physics, Academy of Science of the Czech Republic, Prague, Czech Republic</i>	
<i>J. Laakso, S. Ahmaniemi, P. Vuoristo, T. Mantyla, Tampere University of Technology, Institute of Materials Science, Tampere, Finland</i>	
Improvement of the Properties of Thermally Sprayed Ceramic Coating by the Infiltration of the Adhesives	1311
<i>C.-J. Li, G.-J. Yang, Xi'an Jiaotong University, Xi'an, Shaanxi, P.R. China</i>	
<i>A. Ohmori, Osaka University, Ibaraki, Osaka Japan</i>	

Interconnected Porosity of Plasma Sprayed Alumina Coatings: Evaluation and Modification.....	1317
<i>A. Denoirjean, T. Haure, J. Desmaison, P. Tristant, P. Fauchais, Laboratoire Sciences des Procédés Céramiques et Traitements de Surface, Limoges, France</i>	
<i>A. Maitre, Laboratoire de Chimie du Solide Minéral, Vandoeuvre-Les-Nancy, France</i>	
Evaluation of the Photodecomposition Efficiency of the Nanostructured TiO₂ Sol Precursor Plasma Coatings.....	1325
<i>H. Choi, C. Han, C. Lee, Hanyang University, Seoul, South Korea</i>	
<i>H. Kim, Research Institute of Industrial Science and Technology, Pohang, Korea</i>	
Photocatalytic Properties of TiO₂ Coatings as a Function of Coating and Substrate Characteristics	1331
<i>F. Toma, N. Berger-Keller, G. Bertrand, D. Klein, C. Coddet, LERMPS-UTBM, Belfort, France</i>	
Optical Emission Spectroscopic Diagnostics of Atmospheric Argon Radio Frequency Inductively Coupled Plasma	1337
<i>G. Gao, J. Mostaghimi, L. Pershin, University of Toronto, Toronto, Ontario, Canada</i>	
Analysis of Electronic Properties of TiO₂ (001) Surface Based on Band Calculations	1347
<i>A. Kellou, F. Toma, H. Aourag, D. Klein, C. Coddet, LERMPS-UTBM, Belfort, France</i>	
Rolling Contact Fatigue of Hot Isostatic Pressed WC-NiCrBSi Thermal Spray Coatings	1351
<i>S. Stewart, R. Ahmed, Heriot-Watt University, Edinburgh, Scotland, United Kingdom</i>	
<i>M. Tsuyoshi, Itsukaichi, Fugimi Inc., Gifuken, Japan</i>	
<i>S. Tobe, Ashikaga Institute of Technology, Ashikagashi, Tochigiken, Japan</i>	
Influences of Substrate Roughness and Temperature on Adhesive Strength in Thermal Spray Coatings.....	1361
<i>H. Fukanuma, N. Ohno, Plasma Giken Co., Ltd, Toda City, Saitama, Japan</i>	
Elastic Modulus Measurements via Laser-Ultrasonic and Knoop Indentation Techniques.....	1369
<i>R. Lima, B. Marple, G. Lamouche, S. Kruger, National Research Council of Canada, Boucherville, QC, Canada</i>	
Young's Modulus and Fatigue Behavior of Plasma Sprayed Alumina Coatings.....	1379
<i>O. Kovarik, J. Siegl, Czech Technical University, Prague, Czech Republic</i>	
<i>J. Nohava, P. Chráska, Academy of Sciences of the Czech Republic, Prague, Czech Republic</i>	
Microstructure and Electrical Properties of RF and DC Plasma-Sprayed TiO₂ Coatings	1387
<i>N. Branland, E. Meillot, Commissariat à l'Energie Atomique, Le Ripault, Monts, France</i>	
<i>A. Vardelle, P. Fauchais, SPCTS-University of Limoges, France</i>	
<i>F. Gitzhofer, M. Boulos, CRTP-University of Sherbrooke, Sherbrooke, Québec, Canada</i>	
Quantitative Characterization of the Microstructure of Plasma-sprayed Alumina Coatings Based on Visualization of Infiltrated Element	1395
<i>C.-J. Li, W.-Z. Wang, H.-Y. Wang, Xi'an Jiaotong University, Xi'an Shaanxi, P.R. China</i>	
Influence of Plasma Spray Parameters on Microstructural Characteristics of TiO₂ Deposits.....	1403
<i>G. Bertrand, N. Berger-Keller, C. Coddet, LERMPS/UTBM, Belfort Cedex, France</i>	
<i>C. Meunier, CREST-UMR CNRS 6000, Montbéliard, France</i>	
Structure and Magnetic Properties of Iron-Based Alloys Obtained by APS Thermal Spraying	1409
<i>N.E. Fenineche, M. Cherigui, A. Kellou, H. Aourag, C. Coddet, LERMPS-UTBM, Belfort, France</i>	

Structure and Properties of Plasma Sprayed Wollastonite Coatings	1413
<i>X. Liu, Y. Zeng, C. Ding, Shanghai Institute of Ceramics, Chinese Academy of Sciences, Shanghai, P.R. China</i>	
Microstructural Characterization Across Length Scales of Thermal Sprayed Ni-5wt%Al Coatings	1419
<i>S. Deshpande, S. Sampath, P. Gouma, H. Herman, State University of NY at Stony Brook, Stony Brook, New York, USA</i>	
Investigation of Heat Treatment on the Microstructure of Twin Wire Arc Sprayed Copper Alloys	1429
<i>B. Wielage, S. Steinhäuser, G. Reisel, A. Wank, Chemnitz University of Technology, Chemnitz, Germany</i>	
<i>O. Brandt, Becon Technologies GmbH, Thun, Switzerland</i>	
Microcrystallographic Study of Plasma Sprayed Alumina Deposit by Transmission Electron Microscopy	1433
<i>N. Zahari, M. Sugano, T. Satake, Yamagata University, Yamagata, Japan</i>	
<i>A. Ohmori, Osaka University, Osaka, Japan</i>	
Titanium Suboxide Coatings Prepared by VPS Spraying	1441
<i>T. Naumann, L. Berger, M. Ingwerth, Fraunhofer Institute for Material and Beam Technology, Dresden, Germany</i>	
<i>P. Vuoristo, Tampere University of Technology, Tampere, Finland</i>	
Epoxies Used in Tensile Testing: Film vs. Liquid - Why is There a Difference?	1447
<i>J. Sauer, Sauer Engineering, Cincinnati, Ohio, USA</i>	
<i>S. Ruoff, IMR Test Labs, Ithaca, New York, USA</i>	

Thermal & Environmental Barrier Coatings

New Material Concepts for the Next Generation of Plasma-Sprayed Thermal Barrier Coatings	1455
<i>D. Stöver, G. Pracht, H. Lehmann, M. Dietrich, J. Döring, R. Vaßen, Forschungszentrum Jülich, Jülich, Germany</i>	
Improved Oxidation Life of Segmented Plasma Sprayed 8YSZ Thermal Barrier Coatings	1463
<i>J. Smialek, NASA Glenn Research Center, Cleveland, Ohio, USA</i>	
Study of Unique Microstructure in SPS Ceramic NanoCoatings	1471
<i>X. Ma, Inframat Corporation, Farmington, Connecticut, USA</i>	
<i>J. Roth and T.D. Xiao, US Nanocorp, Inc., Farmington, Connecticut, USA</i>	
<i>M. Gell, Institute of Materials Science, University of Connecticut, Storrs, Connecticut, USA</i>	
Characterization of Modified Thick Thermal Barrier Coatings	1477
<i>S. Ahmaniemi, J. Tuominen, M. Vippola, P. Vuoristo, T. Mäntylä, Tampere University of Technology, Tampere, Finland</i>	
<i>F. Cernuschi, CESI, Segrate, Italy</i>	
<i>C. Gualco, A. Bonadei, Ansaldo Ricerche, Genova, Italy</i>	
<i>R. Di Maggio, Univeristy of Trento/Department of Materials Engineering, Trento, Italy</i>	
Non-Destructive Microstructural Evaluation of Thermal Barrier Coatings by Electrochemical Impedance Spectroscopy	1487
<i>S. Vishweswaraiah, B. Jayaraj, T. Du, V. Desai, Y. Sohn, University of Central Florida, Orlando, Florida, USA</i>	

Thermally Grown Oxides on Electroplated Bond Coats Under APS TBC	1495
<i>A. Khan, T. Duda, Alstom (Switzerland) Ltd., Baden, Switzerland</i>	
<i>A. Taylor, P. Moore, P. Rutter, J. Foster, Praxair Surface Technologies, Somerset, England, United Kingdom</i>	
The Use of Acoustic Emission Techniques for Characterizing Failure Mechanisms of Thermal Barrier Coatings Under Thermal Cycling Conditions	1499
<i>P. Robin, F. Gitzhofer, M. Boulos, Université de Sherbrooke, Sherbrooke, Quebec, Canada</i>	
Analysis of Pore Connectivity Modification and Structure Densification of Y-PSZ Coating after In-Situ Laser Remelting Implementing Electrochemical Test	1507
<i>G. Antou, F. Hlawka, A. Cornet, LISS-ENSAIS, Strasbourg, France</i>	
<i>G. Montavon, C. Coddet, LERMPS-UTBM, Belfort Cedex, France</i>	
<i>J. Staerck, O. Fréneaux, IREPA-Laser, Illkirch, France</i>	
A Raman Study on Plasma-Sprayed Thermal Barrier Coatings During Thermal Cycling	1513
<i>F. Niccolai, U. Bardi, M. Muniz Miranda, University of Florence, Udr. Firenze, Italy</i>	
<i>M. Giannozzi, GE - Nuovo Pignone, Firenze, Italy</i>	
Synthesis and Oxidation Behavior of Nanocrystalline MCrAlY Bond Coats	1517
<i>L. Ajdelsztajn, F. Tang, J. Schoenung, University of California Davis, Davis, California, USA</i>	
<i>J. Picas, Universitat Politècnica de Catalunya, Vilanova i la Geltru, Spain</i>	
<i>G. Kim, Perpetual Technologies, Quebec, Canada</i>	
<i>V. Provenzano, NIST, Gaithersburg, Maryland, USA</i>	
Hot Corrosion Behavior of Graded Thermal Barrier Coatings Formed by Plasma Spraying Process	1525
<i>N. Mifune, Y. Harada, T. Doi, R. Yamasaki, Tocalo Co., LTD., Kobe, Hyogo, Japan</i>	
Functionally Graded HVOF Sprayed NiCr-Al₂O₃ Coatings for Demanding Applications.....	1531
<i>E. Turunen, VTT Industrial Systems, Espoo, Finland</i>	
<i>M. Gasik, E. Antila, Helsinki University of Technology, Espoo, Finland</i>	
Wear Resistance of Nanostructured Thermal Barrier Coatings.....	1535
<i>R. Soltani, T. Coyle, J. Mostaghimi, University of Toronto, Toronto, Ontario, Canada</i>	
Structure and Properties of CaZrO₃ Coatings Prepared by WSP and APS Spraying	1541
<i>K. Neufuss, J. Dubsky, P. Rohan, B. Kolman, P. Chráska, Institute of Plasma Physics ASCR, Prague, Czech Republic</i>	
<i>L. Berger, R. Zieris, Fraunhofer Institute for Material and Beam Technology, Dresden, Germany</i>	
<i>S. Thiele, M. Nebelung, Fraunhofer Institute for Ceramic Technologies, Dresden, Germany</i>	
The Effect of a High Thermal Gradient on Sintering and Stiffening in the Top Coat of a Thermal Barrier Coating (TBC) System	1547
<i>S. Tsipas, I. Golosnoy, T.W. Clyne, University of Cambridge, Cambridge, United Kingdom</i>	
Fracture Mechanics Analysis of Microcracks in Thermally Cycled Thermal Barrier Coatings	1553
<i>C. Persson, Y. Liu, S. Melin, Lund University, Lund, Sweden</i>	
Micromechanical Analysis of Plasma Sprayed TBC: Anisotropic Elastic and Conductive Properties in Terms of Microstructure. Experimental Verification on YSZ Coatings	1557
<i>I. Sevostianov, New Mexico State University, Las Cruces, New Mexico, USA</i>	
<i>M. Kachanov, Tufts University, Medford, Massachusetts, USA</i>	
<i>J. Ruud, P. Lorraine, M. Dubois, General Electric Global Research, Niskayuna, New York, USA</i>	

The Influence of Thermal Barrier Top Coating on the Initiation and Growth of Thermally Grown Oxide	1565
<i>K. Ogawa, N. Gotoh, T. Shoji, Tohoku University, Sendai, Japan</i>	
Correlation Between Spraying Conditions and Micro Crack Density and Their Influence on Thermal Cycling Life of Thermal Barrier Coatings.....	1573
<i>R. Vaßen, F. Traeger, D. Stöver, Forschungszentrum Jülich GmbH, Jülich, Germany</i>	
Behavior and Characterization of Two 7-8 wt% Yttria-Stabilized Zirconia Powders and Coatings Produced Using Plasma Spray Deposition	1583
<i>J. Bisson, C. Moreau, National Research Council Canada, Boucherville, Quebec, Canada</i> <i>M. Dorfman, C. Dambra, J. Mallon, Sulzer Metco, Westbury, New York, USA</i>	
Comparison of Particle In-Flight Characteristics and Coating Properties.....	1591
<i>S. Siegmann, N. Margadant, EMPA Swiss Federal Labs, Thun, Switzerland</i> <i>A. Zagorski, M. Arana-Antelo, Alstom Power, Baden, Switzerland</i>	
Plasma Sprayed Coatings with Engineered Microstructures	1599
<i>S. Basu, G. Ye, M. Gevelber, C. Cui, D. Wroblewski, Boston University, Boston, Massachusetts, USA</i> <i>J. Fincke, W. Swank, INEEL, Idaho Falls, Idaho, USA</i>	
Processing of Y-PSZ Thermal Barrier Coatings Implementing a High Power Laser Diode: Process Parameters	1609
<i>G. Antou, F. Hlawka, A. Cornet, LISS-ENSAIS, Strasbourg, France</i> <i>G. Montavon, C. Coddet, LERMPS-UTBM, Belfort Cedex, France</i> <i>J. Staerck, O. Fréneaux, IREPA-Laser, Illkirch, France</i>	
Influence of Spraying Variables and of a New Zirconia Hollow Powder on the Microstructure of Plasma Sprayed Thermal Barrier Coating.....	1617
<i>P. Roy, G. Bertrand, C. Coddet, LERMPS/UTBM, Belfort, France</i>	
A New Environmental Barrier Coating System on Carbon-Fiber Reinforced Silicon Carbide Composites	1625
<i>S. Latzel, R. Vaßen, D. Stöver, Forschungszentrum Jülich, Jülich, Germany</i>	
Phase Precipitation in NiCoCrAlY Bondcoat at High Temperature	1631
<i>T. Koomparking, S. Damrongrat, King Mongkut's University of Technology, Thonburi, Bangkok, Thailand</i> <i>P. Niranatlumpong, National Metals and Material Technology Center, Pathumthani, Thailand</i>	

Thermal Spraying of Polymers

Thermal Spraying of Polymers: Spraying Processes, Materials and New Trends.....	1635
<i>S. Hartmann, R. Winkler, F. Buelmann, SLV Duisburg, NL der GSI mbH, Duisburg, Germany</i> <i>A. Jerz, FKUR - Forschung und Engineering GmbH, Willich, Germany</i>	
Influence of Polymer Composition on the Deposition of UHMWPE Coatings.....	1639
<i>D. Gawne, Y. Bao, South Bank University, London, United Kingdom</i> <i>T. Zhang, Kingston University, London, United Kingdom</i>	
Production of Composite Powder by Fluidized-bed Granulation Process and Evaluation of Sprayed Coating Properties.....	1645
<i>R. Kawase, A. Mizuma, Y. Tanaka, Ariake National College of Technology, Ohmuta, Fukuoka, Japan</i>	

Analysis of Deposition Process for Composite Polymer Thermally Sprayed Coatings..... 1651
Y. Borisov, I. Sviridova, V. Korzhik, The E.O. Paton Electric Welding Institute, NASU, Ukraine, Kiev
N. Fialko, Institute of Technical Thermal Physics, Ukraine, Kiev

Ceramic / Fluoropolymer Composite Coatings by Thermal Spraying: Effects of Parameters 1659
C. Mateus, S. Costil, C. Coddet, LERMPS-UTBM, Belfort, France

Microstructure and Properties of Thermally Sprayed Functionally Graded Coatings for Polymeric Substrates 1667
R. Knight, M. Ivosevic, S. Kalidindi, G. Palmese, Drexel University, Philadelphia, Pennsylvania, USA
J. Sutter, NASA-Glenn Research Center, Cleveland, Ohio, USA

Residual Stresses in Inconel 625 Coating of Organic-Based Composites Obtained by Plasma Spraying with Atmosphere and Temperature Control (ATC) 1675
B. Henry, F. Borit, V. Guipont, M. Jeandin, Ecole des Mines de Paris, Evry, France
D. Pachoutinsky, Ecole des Mines / Centre des Matériaux P.M Fourt, Evry, France
J. Lu, Université Technologique De Troyes / GSM, Troyes, France
E. Welvaert, SNFR, Ingwiller, France

Optimal Substrate Preheating Model for Thermal Spray Deposition of Thermosets onto Polymer Matrix Composites..... 1683
M. Ivosevic, R. Knight, S. Kalidindi, G. Palmese, Drexel University, Philadelphia, Pennsylvania, USA
A. Tsurikov, Naval Surface Warfare Center, Carderock Division, West Bethesda, Maryland, USA
J. Sutter, NASA-Glenn Research Center, Cleveland, Ohio, USA

Evaluation of Thermally Sprayed and Other Polymeric Coatings for Use in Natural Gas Pipeline Components 1693
E. Turunen, P. Vuoristo, E. Leivo, M. Leino, P. Järvelä, T. Mäntylä, Tampere University of Technology, Tampere, Finland

Fracture and Rheological Behavior of Oxide Aluminum-Polymer Composite Sliding Bearing..... 1703
M. Kireitseu, Institute of Mechanics and Machine Reliability, Minsk, Belarus

Title Index..... xxix

Author Index xxxvii

Company Index..... xlv

Key Word Index li