Foreword

The 20th International Conference on Surface Modification Technologies was held between September 25–29, 2006 at the Congress Center in Vienna, Austria in conjunction with the 15th IFHTSE meeting sponsored by ASMET. Several hundred people attended the joint sessions of IFHTSE/SMT and delegates from over 30 countries presented papers in the various parallel sessions. All the papers presented in this proceedings were peer reviewed and corrected prior to publication. The meeting was cosponsored by IOM UK and the proceedings is published by ASM International.

Each paper in this proceedings reflects significant work by the authors, some of whom ensured that the practical applications of surface engineering were emphasized. The dedication of the authors and the session chairs in completing their individual sessions on time must be commended along with the excellent interactions at the end of each paper presented. We would like to thank the numerous anonymous reviewers for their generous donation of time and for their patience and assistance to take on this activity at short notice.

We would also like to acknowledge the support of all of the ASMET staff for their excellent organization of the traditional Viennese Heurigger and the conference dinner hosted by the Mayor of Vienna. The SMT organizers would also like to thank Dr Heimo Jager for his patience and ability to do things in a very professional manner. The efforts of Nicolle Mueller and Yvonne Krenn in handling all the numerous enquiries related to the planning and execution of this meeting is appreciated and a special thanks goes to Bob Wood for enabling this meeting of the SMT with IFHTSE.

T.S.Sudarshan  
Materials Modification Inc.  
Fairfax, Virginia

J.J. Stiglich  
Advanced Materials and Processes  
Breckenridge, Colorado
# Session Chairs

<table>
<thead>
<tr>
<th>Session</th>
<th>Chair</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosion Resistant Coatings</td>
<td>J.J. Stiglich</td>
<td>Advanced Materials Associates</td>
</tr>
<tr>
<td>Processing of Materials</td>
<td>J.J. Stiglich</td>
<td>Advanced Materials Associates</td>
</tr>
<tr>
<td>Plasma Thermal Spraying</td>
<td>Amelia Almeida</td>
<td>Instituto Superior Tecnico</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Department of Materials Engineering</td>
</tr>
<tr>
<td>Surface Treatment</td>
<td>Amelia Almeida</td>
<td>Instituto Superior Tecnico</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Department of Materials Engineering</td>
</tr>
<tr>
<td>Vapor Deposition Processes</td>
<td>Ulf Seyfert</td>
<td>Vonardenne Anlagentechnik GmbH</td>
</tr>
<tr>
<td>Wear Resistant Coatings</td>
<td>Karl Berreth</td>
<td>Material Testing Institute (MPA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>University of Stuttgart</td>
</tr>
</tbody>
</table>
Contents

Corrosion Resistant Coatings

Environmentally Friendly Anti-Corrosion Primers for Hot-Dip Galvanized (HDG) Steel ................................................................. 1
C. Shivane, P. Puomi, W.J. van Ooij,
University of Cincinnati, Cincinnati, OH, USA

Corrosion Protection of Press-Hardened Structure Parts by Zinc Diffusion Coating ................................................................. 5
W. Graf1, M. Saupe1, F. Natrup1, E. Rodriguez1, M. Pohl2, E. Danger2, E. Seidl2,
Bodycote Wärmebehandlung1, Ebersbach, Germany;
Benteler Automobiltechnik2, Paderborn, Germany

Chromate Replacement in Aluminum Corrosion Protection Coatings ................................................................. 9
S. Hansal1, W.E.G. Hansal1, W.J. van Ooij2, P. Puomi2,
Happy Plating GmbH1, Berndorf, Austria; University of Cincinnati2, Cincinnati, OH, USA

Processing of Materials

Study of Laser Clad Cu-NbC Nanocomposite Coatings ................................................................. 13
S. Eugénio1, A. Almeida1, R. Vilar1, V. Livramento2, M.T. Marques2, J.B. Correia2,
Instituto Superior Técnico1, Lisbon, Portugal; INETI2, Lisbon, Portugal

Laser Deposition Welds with High Heat Conductivity for Thermal Management Applications ....................................................... 18
G. Ernst1, M. Kerschbaumer1, G. Polding1, M. Eidenhammer2,
Laserzentrum Leoben der Joanneum Research Forschungsges mbH1,
Niklasdorf, Austria; Profactor Produktionsforschung GmbH1, Steyr, Austria

Morphological and Compositional Modifications in KrF Excimer Laser Irradiated Human Enamel ......................................................... 23
M. Sivakumar, V. Oliveira, S. Eugénio, R. Vilar, A.M. Botelho do Rego,
Instituto Superior Técnico, Lisboa, Portugal

Microstructure of Laser Clad Al-Si/SiCp Coatings ............................................................................ 26
R. Anandkumar1, A. Almeida1, R. Colaço1, R. Vilar1, V. Ocelik2, J.Th.M. De Hosson2,
Instituto Superior Técnico1, Lisboa, Portugal; University of Groningen2,
Groningen, The Netherlands
Plasma Thermal Spraying

A Composite Approach to Al₂O₃-based Plasma-Sprayed Coatings ........................................ 30
O. Amsellem¹, F. Borit¹, V. Guipont¹, M. Jeandin¹, F. Pauchet²,
École des Mines de Paris¹, Evry Cedex, France; Schlumberger², Clamart, France

Thermal Stability during Plasma Spray Deposition of Hydroxyapatite Sol-Gel Derived Nanopowders .......................................................... 35
R. Gonzalez-McQuire¹, A. Tsetsekou¹, A. Zaroulias², M. Vardavoulias²,
National Technical University of Athens¹, Athens, Greece;
PyroGenesis SA², Lavrio, Greece

Plasma Spray Coatings of Sol-Gel Ceramic Nanopowders ........................................................................ 39
A. Tsetsekou¹, E. Tsioutsioulikli¹, N. Petsas², M. Vardavoulias²,
National Technical University of Athens¹, Athens, Greece;
PyroGenesis SA², Lavrio, Greece

Influence of Processing Parameters on Shot Coating of Graphite Powder ........................................ 44
K. Hanada¹, K. Hatsukano¹, K. Matsuzaki¹, T. Sano²,
National Institute of Advanced Industrial Science and Technology (AIST)¹,
Tsukuba, Ibaraki, Japan; Chiba Institute of Technology², Narashino, Chiba, Japan

Surface Treatment

PVD Coatings to Enhance Service Performance of Die Casting Dies for Aluminum Alloy .......................................................... 49
D. Ugues¹, E. Torres¹, M. Rosso¹, M. Perucca², G. Krawczyk³,
Politecnico di Torino¹, Torino, Italy; CleanNTLab—Environment Park²,
Torino, Italy; Silesian University of Technology³, Gliwice, Poland

Replacement of Case Hardening of Gearing Components by Induction Surface Hardening with the Eldec SDF® Method ................................................ 54
H.-J. Peter, W. Schwenk,
Eldec Schwenk Induction GmbH, Dornstetten, Germany

Vapor Deposition Processes

Improvement of Salt Corrosion Resistance of Titanium Alloys by PVD and CVD Coatings .......................................................... 59
J.D. Béguin¹, D. Adrian¹, J.A. Petit¹, J.P. Rivière², C. Vahlas³, S. Vaillant⁴,
LGP-ENIT¹, Tarbes, France; LMP-UMR6630-CNRS², Poitiers, France;
CIRIMAT-ENSIACET³, Toulouse, France;
DT/DMTA/EAP-Turboméca-Groupe SAFRAN⁴, Bordes, France
Technical Aspects of Pulsed CVD Siliconizing of Steel Surfaces ........................................64
K. Maile, K. Berreth, A. Lyutovich,
University of Stuttgart, Stuttgart, Germany

Wear Resistant Coatings

A Comparative Study between As-Deposited and Heat-Treated HVOF-Sprayed Ni-Base Coatings..........................................................67
G. Bolelli¹, L. Lusvarghi¹, T. Manfredini¹, F.P. Mantini¹, F. Casadei²,
University of Modena and Reggio Emilia¹, Modena, Italy;
Centro Sviluppo Materiali S.p.A.², Roma, Italy

Micro Abrasive Wear Evaluation on WC Coatings with Different Binders Applied by HVOF Process ..........................................................73
E.A.B. Arnoni¹, R. Nucci², G.E. Totten³, A.L. Neto⁴, L.C. Casteletti⁴,
Petrobrás¹, São Paulo, Brazil; Ogramac², São Paulo, Brazil;
Portland State University³, Portland, OR, USA;
Escola Engenharia de São Carlos⁴, São Carlos, São Paulo, Brazil

Wear Resistant Al₃Nb Based Surface Alloys Developed by Laser Alloying ..................78
A. Almeida, R. Vilar,
Instituto Superior Técnico, Lisboa, Portugal

NiTi Coating by Plasma Transferred Arc Surfacing for Improving Wear Resistance of Titanium ...........................................................83
T. Owa¹, T. Shinoda²,
Nagano Prefectural Institute of Technology¹, Ueda, Nagano, Japan;
Nagoya University², Nagoya, Aichi, Japan

Influence of Welding Parameters on Microstructure and Abrasive Wear Behavior of Synthetic Multiphase Materials ..................................88
M. Kirchgaßner¹, E. Badisch², H. Weiss², F. Franek²,
Castolin Ges.m.b.H¹, Vienna, Austria; AC²T Research GmbH, Wiener Neustadt, Austria

Erosion and Impact Wear Resistance of Thermal Sprayed Coatings ..........................94
P. Kulu, R. Tarbe, R. Veinthal,
Tallinn University of Technology, Tallinn, Estonia

Posters

Surface Hardened Molybdenum Alloys for the Processing of Polymers ......................100
H.-P. Martinz, B. Nigg,
Plansee SE, Reutte, Austria
Tribological Properties of Electroless Codeposited Ni-P/TALC Composite Coatings

B. Etcheverry¹, J. Alexis¹, J.Y. Paris¹, J.A. Petit¹, J.P. Bonino²,
Ecole Nationale d’Ingénieurs de Tarbes¹, France;
Université Paul Sabatier², France

Effect of Zirconia Addition on Microstructure and Surface Properties of Chromoaluminized Steel

M.A. El-Zomor, M.H. Ahmed,
Tabbin Institute for Metallurgical Studies, Cairo, Egypt

Ion Nitriding and Nitrocarburizing of Stainless Steels and Its Influence in the Corrosion Resistance

A.M. de Oliveira¹, A.L. Neto³, G.E. Totten³, L.C. Casteletti²,
CEFET³, São Luiz, Maranhão, Brazil; Escola Engenharia de São Carlos²,
São Carlos, São Paulo, Brazil; Portland State University³, Portland, OR, USA

Production and Evaluation of AISI 420 Steel Coatings Obtained by Thermal-Spray Processes

E.A.B. Arnoni¹, R. Nucci², G.E. Totten³, A.L. Neto⁴, L.C. Casteletti⁴,
Petrobrás¹, São Paulo, Brazil; Ogramac², São Paulo, Brazil;
Portland State University³, Portland, OR, USA;
Escola Engenharia de São Carlos⁴, São Carlos, São Paulo, Brazil

Modeling of Erosion Wear of Powder Composite Materials and Coatings

R. Veinthal¹, P. Kulu¹, H. Käerdi²,
Tallinn University of Technology¹, Tallinn, Estonia;
Estonian National Public Service Academy², Tallinn, Estonia

Influence of the Parameters Carburizing on Wear Resistance of Hot and Cold-Work Tool Steels

T. Babul¹, A. Nakonieczny¹, J. Senatorski¹, N. Kucharieva²,
Institute of Precision Mechanics¹, Warsaw, Poland;
Polytechnic University²*, Minsk, Belorussia

Recycling of Waste Powder Material of a Thermal Spray Shop

A. Tsetsekou¹, E. Papoulas¹, G. Papapanos², M. Vardavoulas³,
National Technical University of Athens¹, Athens, Greece;
PyroGenesis SA², Lavrio, Greece

The Crystal and Amorphous Phases in Cladding Layer by Compressed Arc Plasma Beam

Y. Wu¹, P. Lin¹, Z. Peng²,
Hohai University¹, Nanjing, China;
Zhongyuan Institute of Technology², Zhengzhou, China

Author Index

© 2007 ASM International. All Rights Reserved.