

SYMPOSIUM HH

High-Temperature Thermal Spray Coatings—Thermal Barrier Coatings

December 2 – 3, 2002

Chairs

Y. C. Lau General Electric Global Research Center
Joachim Heberlein Univ of Minnesota
Christian Moreau Natl Research Council Canada
Montia Nestler Sulzer Metco Inc

Symposium Support

General Electric Global Research Center
Sulzer Metco

* Invited paper

SESSION HH1: PROCESS OPTIMIZATION AND CONTROL

Chairs: Christian Moreau and Curtis A. Johnson
Monday Morning, December 2, 2002
Independence East (Sheraton)

8:30 AM *HH1.1

PLASMA SPRAYING OF LIQUID PRECURSORS TO OBTAIN NANOSTRUCTURED COATINGS. P. Fauchais, J-F. Coudert, J. Fazilleau, Laboratoire Sciences des Procédés Céramiques et Traitements de Surface, UMR-CNRS 6638, Université de Limoges, Limoges, FRANCE; L. Bianchi, Commissariat à l'énergie Atomique, Le Ripault, Monts, FRANCE.

9:00 AM *HH1.2

TWIN-HYBRID PLASMA SPRAY SYSTEM FOR THERMAL BARRIER COATINGS. Toyonobu Yoshida, Department of Materials Engineering, The University of Tokyo, Tokyo, JAPAN.

9:30 AM *HH1.3

DEVELOPMENT POTENTIAL OF EXISTING THERMAL BARRIER MATERIALS. Andrew R. Nicoll, Global Materials, Sulzer Metco (US) Inc., Westbury, NY.

10:00 AM BREAK

10:30 AM HH1.4

FORMATION OF THERMAL BARRIER COATINGS IN SOLUTION PRECURSOR PLASMA SPRAY PROCESS. Liangde Xie, University of Connecticut, Dept of Metallurgy and Materials Engineering, Storrs, CT; Xinqin Ma, Inframat Corp., Farmington, CT; Alper Ozturk, University of Connecticut, Dept of Mechanical Engineering, Storrs, CT; Eric H. Jordan, University of Connecticut, Dept of Mechanical Engineering, Storrs, CT; Nitin P. Padture, University of Connecticut, Dept of Metallurgy and Materials Engineering, Storrs, CT; Baki M. Cetegen, University of Connecticut, Dept of Mechanical Engineering, Storrs, CT; Maurice Gell, University of Connecticut, Dept of Metallurgy and Materials Engineering, Storrs, CT.

10:45 AM HH1.5

EFFECT OF IMPERMEABLE THIN ALUMINA-OVERLAY ON SULFATE/VANADATE HOT-CORROSION OF TBC. Zheng Chen, Scott X. Mao, Zhiwei Shan, University of Pittsburgh, Dept of Mechanical Engineering, Pittsburgh, PA; Nianqiang Wu, Northwestern Univ, Dept of Chemistry, Evanston, IL.

11:00 AM HH1.6

FLAME SPRAY DEPOSITION OF ALUMINUM OXIDE USING SOL-GEL FEEDSTOCK. N. Bahlawane, B. Atakan[†], K. Kohse-Hoinghaus Physical Chemistry I, Bielefeld University, Bielefeld, GERMANY; [†]Institute of Combustion and Gasdynamics, Gerhard-Mercator-Duisburg University, Duisburg, GERMANY.

11:15 AM HH1.7

ENGINEERING PLASMA SPRAYED COATING MICROSTRUCTURE BY ADVANCED CONTROL. S.N. Basu, G. Ye, C. Cui, M. Gevelber, D. Wroblewski, College of Engineering, Boston University, Boston, MA; J.R. Fincke, W.D. Swank, Idaho National Engineering and Environmental Laboratory, Idaho Falls, ID.

11:30 AM HH1.8

PROCESS SIMULATOR FOR PREDICTING PLASMA SPRAY COATING THICKNESS. H.P. Wang, H.W. Ng^a, Erin M. Perry, A. Devasenapathi^a, Michael C. Ostrowski, GE Global Research, Niskayuna, NY; ^aNanyang Technological University, School of Mechanical and Production Engineering, SINGAPORE.

11:45 AM HH1.9

SPLATS FORMATION OF THERMALLY SPRAYED MOLYBDENUM AND ZIRCONIA: A CONTRIBUTION TO PROCESS MAP STUDY. Li Li, Anirudha Vaidya, Sanjay Sampath, State University of New York at Stony Brook, Dept of Materials Science and Engineering, Stony Brook, NY; Hui Zhang, State University of New York at Stony Brook, Dept of Mechanical Engineering, Stony Brook, NY; Xiangyang Jiang, Caterpillar Inc., Peoria, IL.

SESSION HH2: DEGRADATION AND FAILURE MECHANISMS, LIFE PREDICTION

Chairs: Y. C. Lau and Herbert Herman
Monday Afternoon, December 2, 2002
Independence East (Sheraton)

1:30 PM *HH2.1

DESIGNING THE MATERIAL PROPERTIES OF NANOSTRUCTURED ZIRCONIA-BASED DEPOSITS. Chris Berndt, Stony Brook University, Materials Science and Engineering, Stony Brook, NY; Ahmet Kucuk, Karl Storz Endovision, Charlton, MA; Rogerio Lima, National Research Council Canada, Boucherville, CANADA.

2:00 PM *HH2.2

TBC FAILURE MECHANISMS FROM DEPOSITS OF AIRBORNE CONTAMINATES. Curtis A. Johnson, General Electric Global Research, Ceramic and Metallurgy Technologies, Schenectady, NY.

2:30 PM HH2.3

FAILURE MECHANISMS OF DENSE VERTICALLY CRACKED THERMAL BARRIER COATINGS AT THREE DIFFERENT TEMPERATURES. Manish Madhwal, Maurice Gell, University of Connecticut, Institute of Materials Science, Storrs, CT; Eric Jordan, University of Connecticut, Dept of Mechanical Engineering, Storrs, CT.

2:45 PM HH2.4

EFFECTS OF THERMAL CYCLING ON THE PROPAGATION OF DELAMINATION CRACKS IN THERMAL BARRIER SYSTEMS. Ming Y. He, Tao Xu, A.G. Evans, Materials Department, University of California, Santa Barbara, CA.

3:00 PM BREAK

3:30 PM HH2.5

DEGRADATION OF APS-SYSZ THERMAL BARRIER COATINGS ON ALPHA-ALUMINA MODIFIED BOND COATS DURING HIGH TEMPERATURE EXPOSURE. Mohammed Chunggaze, Gordon Kidd, SIFCO Turbine Components Ltd, Carrigtwohill, Cork, IRELAND; Michael Auger, IonBond AG, Olten, SWITZERLAND.

3:45 PM HH2.6

DAMAGE AND OXIDE STRESS EVOLUTION AS A FUNCTION OF TEMPERATURE, TIME, AND CYCLES IN TBC's. Swetha Sridharan, Eric Jordan, Univ of Connecticut, Dept of Mechanical Engineering, Storrs, CT; Maurice Gell, Univ of Connecticut, Dept of Metallurgy and Materials Engineering, Storrs, CT.

4:00 PM HH2.7

Abstract Withdrawn

SESSION HH3: IN-ROOM POSTER SESSION

Chairs: Y. C. Lau and Herbert Herman
Monday Afternoon, December 2, 2002
4:15 PM
Independence East (Sheraton)

HH3.1

LASER SURFACE TREATMENT OF THERMAL BARRIER COATINGS. Ricardo M. Ribeiro, Vasco Teixeira, A. Portinha, Departamento de Fisica, Universidade do Minho, Braga, PORTUGAL; Carlos Oliveira, IDIT, Santa Maria da Feira, PORTUGAL.

HH3.2

HIGH-TEMPERATURE XRD RESIDUAL STRAIN MEASUREMENTS IN ALUMINA SCALE. Thomas R. Watkins, O. Burl Cavin, Jianming Bai, Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, TN.

HH3.3

MICROSTRUCTURAL CHARACTERIZATION OF THE TGO IN AN EB-PVD ZrO₂-BASE TBC ON A Ni-BASE SUPERALLOY TURBINE BLADE AFTER ACTUAL SERVICE USE. Lichun Zhang and Arthur H. Heuer, Case Western Reserve University, Department of Materials Science and Engineering, Cleveland, OH.

SESSION HH4: STRUCTURE/PROPERTY RELATIONSHIPS

Chairs: Montia Nestler and Pierre Fauchais
Tuesday Morning, December 3, 2002
Independence East (Sheraton)

8:30 AM *HH4.1

PREDICTING THERMAL PROPERTIES FROM MICROSTRUCTURES. Edwin R. Fuller Jr., National Institute of Standards and Technology, Gaithersburg, MD; James Ruud, N.S. Hari, James C. Grande, Antonio Mogro-Campero, GE Corporate Research and Development, Schenectady, NY.

9:00 AM *HH4.2

MICROSTRUCTURE-PERFORMANCE RELATIONSHIPS FOR AIR PLASMA SPRAYED THERMAL BARRIER COATINGS. James Ruud, GE Global Research, Niskayuna, NY.

9:30 AM HH4.3

VOID MORPHOLOGY OF THERMALLY SPRAYED NICRALY DEPOSITS IN RELATION TO THERMAL AND ELECTRICAL CONDUCTIVITY. Thomas Keller, Werner Wagner, Paul Scherrer Institut, Villigen, SWITZERLAND; Nikolaus Margadant, Stephan Siegmann, EMPA Swiss Federal Laboratories for Materials Testing and Research, Thun, SWITZERLAND; Anand Kulkarni, SUNY at Stony Brook, Stony Brook, NY.

9:45 AM HH4.4

THE EVOLUTION OF VOID MICROSTRUCTURES IN Y₂O₃-STABILIZED ZrO₂ COATINGS. T.A. Dobbins^{a,b}, M.J. Mayo^a, A.J. Allen^b, J. Ilavsky^b, G.G. Long^b; ^aDept of Materials Science, The Pennsylvania State University, University Park, PA; ^bMaterials Science and Engineering Laboratory, National Institute for Standards and Technology, Gaithersburg, MD.

10:00 AM BREAK**10:30 AM HH4.5**

AN ANALYSIS OF EVOLUTION OF STRESS-STATES IN FUNCTIONALLY GRADED MATERIALS USING VORONOI ELEMENTS. S.B. Biner, Ames Laboratory, Iowa State University, Ames, IA.

10:45 AM HH4.6

BOND COAT SURFACE RUMPLING IN THERMAL BARRIER COATINGS. Rahul Panat, Sulin Zhang, K. Jimmy Hsia, Dept of Theoretical and Applied Mechanics, University of Illinois, Urbana, IL.

11:00 AM HH4.7

HIGH-TEMPERATURE COATING LAYER DESIGN FOR Mo-Si-B ALLOY. J.S. Park, R. Sakidja, J.H. Perepezko, University of Wisconsin-Madison, Dept of Materials Science & Engineering, Madison, WI; J. Fournelle, University of Wisconsin-Madison, Dept of Geology and Geophysics, Madison, WI.

11:15 AM HH4.8

PLASMA SPRAYED DEPOSITION OF Al-Ti-Cr COATING FOR OXIDATION PROTECTION OF TiAl ALLOYS. J.K. Lee, D.M. Wee, Department of Materials Science and Engineering, KAIST, Daejeon, KOREA; M.H. Oh, Department of Materials Science and Engineering, KNUT, Gumi, KOREA; W.J. Quadackers, Forschungszentrum Jülich, Jülich, GERMANY; H.K. Lee, Department of Welding and Production Engineering, Hanbat National Univ, Daejeon, KOREA.

1:30 PM *HH5.1

PORE STRUCTURE OF THERMAL BARRIER COATINGS. Herbert Herman, Anand Kulkarni and Sanjay Sampath, Center for Thermal Spray Research, SUNY-Stony Brook, Stony Brook, NY.

2:00 PM HH5.2

A REVIEW OF RECENT ADVANCES IN TBC MICRO-STRUCTURE CHARACTERIZATION BY NEUTRON AND X-RAY SCATTERING. Andrew Allen, Tabbetha Dobbins, Gabrielle Long, NIST, Gaithersburg, MD; Jan Ilavsky, University of Maryland, College Park, MD; Anand Kulkarni, Herbert Herman, SUNY, Stony Brook, NY; Allen Goland, Brookhaven National Laboratory, Upton, NY.

2:15 PM HH5.3

USE OF X-RAY TOMOGRAPHY FOR CHARACTERIZATION OF THERMALLY SPRAYED AND ELECTRON-BEAM PHYSICALLY VAPOR DEPOSITED THERMAL BARRIER DEPOSITS. Jan Ilavsky, Tabbetha Dobbins, Gabrielle Long, NIST, Gaithersburg, MD; Anand Kulkarni, Herbert Herman, SUNY, Stony Brook, NY; Francesco DeCarlo, ANL, Argonne, IL.

2:30 PM HH5.4

APPLICATION OF IMAGE ANALYSIS FOR CHARACTERIZATION OF POROSITY IN THERMAL SPRAY COATINGS AND CORRELATION WITH SMALL ANGLE NEUTRON SCATTERING. Swarnima Deshpande, Anand Kulkarni, Anirudha Vaidya, Sanjay Sampath, Herbert Herman, State University of New York at Stony Brook, Dept. of Materials Science and Engineering, Stony Brook, NY.

2:45 PM HH5.5

THE APPLICATION OF NEW GENERATION TEM SPECIMEN PREPARATION METHODS TO HVOF THERMALLY SPRAYED COATINGS. Gaoning Kong, P.D. Brown, D.G. McCartney, University of Nottingham, School of Mechanical, Materials, Manufacturing Engineering and Management, Nottingham, UNITED KINGDOM.

3:00 PM BREAK**3:30 PM HH5.6**

ASSESSMENT OF DAMAGE EVOLUTION IN THERMAL BARRIER COATING USING A NDE TECHNIQUE – THERMAL WAVE IMAGING. Golam Newaz, Wayne State University, Dept. of Mechanical Engineering and Institute of Materials Research, Detroit, MI.

3:45 PM HH5.7

NON-DESTRUCTIVE EVALUATION OF CRACK FORMATION IN THERMAL BARRIER COATINGS USING IMPEDANCE SPECTROSCOPY. Md Shawkat Ali, Brunel University, Dept. of Mechanical Engineering, Uxbridge, UNITED KINGDOM; Ping Xiao, Manchester Materials Science Centre, University of Manchester, Manchester, UNITED KINGDOM.

4:00 PM HH5.8

ELASTIC MODULUS OF THERMAL BARRIER COATINGS EVALUATED BY INDENTATION – RELATIONSHIP BETWEEN THE PROCESSING AND MICROSTRUCTURE. Lubos Prchlik, Anand Kulkarni, Sanjay Sampath, Herbert Herman, Dept. of Materials Science and Engineering, State University of New York, Stony Brook, NY.

4:15 PM HH5.9

A METHOD TO MEASURE RADIATIVE PROPERTIES OF THERMAL BARRIER COATINGS. Ted D. Bennett, Dept. of Mechanical and Environmental Engineering, University of California, Santa Barbara, CA.

4:30 PM HH5.10

CHARACTERIZATION OF THERMAL BARRIER COATINGS PRODUCED USING SOLUTION PRECURSOR PLASMA SPRAY PROCESS. Liangde Xie, University of Connecticut, Dept of Metallurgy and Materials Engineering, Storrs, CT; Xinqin Ma, Inframat Corp., Farmington, CT; Eric H. Jordan, University of Connecticut, Dept of Mechanical Engineering, Storrs, CT; Nitin P. Pature, University of Connecticut, Dept of Metallurgy and Materials Engineering, Storrs, CT; Maurice Gell, University of Connecticut, Dept of Metallurgy and Materials Engineering, Storrs, CT.

SESSION HH5: COATING OPTIMIZATION AND CHARACTERIZATION

Chairs: Joachim Heberlein and James A. Ruud
Tuesday Afternoon, December 3, 2002
Independence East (Sheraton)