

Preliminary Program

Thermal and Environmental Barrier Coatings

August 17-22nd, 2003

**Kloster Irsee/Swabian Conference Center
Irsee, Germany**

Conference Chairs

David R. Clarke

Anthony Evans

Manfred Ruehle

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Air Force Office for Scientific Research

Office of Naval Research

Office of Naval Research International Office

Sunday, 17th August 2003

- 16:30 – 18:30 Registration
- 18:30 – 20:00 Dinner
- 21:00 – 23:00 Opening Reception (Bierstube)

Monday, 18th August 2003

Session I: Introductory Session

- 07:00 – 08:30 Breakfast
- 08:45 – 09:00 Welcome
- 09:00 – 09:35 Michael Maloney, Pratt and Whitney
Historical Development of Thermal Barrier Coatings
- 09:35 – 10:10 Ram Darolia, GE Aerospace
Industrial Perspective of TBCs for Aerospace
- 10:10 – 10:40 Coffee Break
- 10:40 – 11:15 Matthias Oechsner, Siemens Power Systems
Industrial Perspective of TBCs for Power Generation
- 11:15 – 12:00 Anthony Evans, University of California, Santa Barbara
TBCs as Interacting Multilayer Systems
- 12:00 – 13:30 Lunch

Session II: Oxidation Issues

- 13:30 – 14:05 W. J. Quaddakers, Julich
Oxidation of MCrAl Bond Coats
- 14:05 – 14:40 Bruce Pint, Oak Ridge National Laboratory
Oxidation of PtNiAl Aluminides
- 14:40 – 15:10 Gerry Meier, University of Pittsburgh
Growth Strain Accompanying Oxidation
- 15:10 – 15:30 Afternoon Coffee Break
- 15:30 – 16:05 David Srolovitz, Princeton University
Stress Development During Growth of Oxide Scales

Monday, 18th August 2003 (continued)

- 16:05 – 17:30 ***Round-Table Discussion on Oxidation Stresses***
- 18:30 – 20:00 Dinner
- 20:00 – 21:00 ***Discussion: Future needs in understanding oxidation stresses***
- 21:00 – 22:00 Social Hour (Bierstube)

Tuesday, 19th August 2003

- 07:00 – 08:15 Breakfast

Session III: Mechanical Properties of TBC Systems

- 08:30 – 09:05 Joachim Roesler, Technical University of Braunschweig
Modeling TBC System Stresses and Failure
- 09:05 – 09:40 Bill Clyne, University of Cambridge
Microstructural and Property Changes in the Top Coat of Plasma-Sprayed Coatings During Service
- 09:40 – 10:15 Kevin Hemker, John Hopkins University
Bond Coat Mechanical Properties and Microstructural Evolution
- 10:15 – 10:45 Coffee Break
- 10:45 – 11:20 Daniel Balint, Harvard University
Modeling of Oxide Undulation Growth
- 11:20 – 11:55 Alan Cocks, Leicester University
Pegging Phenomena
- 12:00 – 13:30 Lunch
- 13:30 – 16:30 ***Round-Table Discussion on Mechanical Properties, Rumpling and Oxidation-Induced Instabilities***
- 18:30 – 20:00 Dinner

Tuesday, 19th August 2003 (continued)

Session IV: TBC Deposition Methods

- 20:00 – 20:35 Nitin Padture, University of Connecticut
Solution Precursor Plasma Spray for depositing TBCs
- 20:35 – 21:10 David Wortman, General Electric Global Research Center
Electron Beam Deposition of TBCs
- 21:10 – 22:30 **Round Table Discussion and Social hour**

Wednesday, 20th August 2003

- 07:00 – 08:15 Breakfast

Session V: Thermal Conductivity Measurements and Models

- 08:30 – 09:05 Daniele Fournier, CNRS
Photothermal Experimental Techniques: Application to TBCs
- 09:05 – 09:40 Ted Bennett, University of California, Santa Barbara
In-situ Thermal Conductivity Measurements of Coatings
- 09:40 – 10:15 Dongming Zhu, NASA Glenn Research Center
Measuring Thermal Conductivity at High Temperatures
- 10:15 – 10:45 Coffee Break
- 10:45 – 11:20 David Cahill, University of Illinois, Urbana
Heat Transport by Lattice Vibrations: Disorder and Interfaces
- 11:20 – 11:55 Simon Phillpott, Argonne National Laboratory
Multiscale Simulation of Thermal Transport
- 12:00 – 14:00 Lunch
- 14:00 – 15:30 **Round Table Discussions on Thermal Conductivity Issues**
- 15:30 – 16:00 ***Poster Session: Recent Developments***
Brief presentations by authors
- 16:00 – 18:30 ***Poster Session with refreshments***
- 18:30 – 20:00 Dinner

Wednesday, 20th August 2003 (continued)

20:00 – 22:00 **Poster session (continued)/social hour**

Thursday, 21st August 2003

07:00 – 08:30 Breakfast

Session VI: Diffusion and Phase Stability

08:45 – 09:20 J.-C. Zhao, General Electric Global Research Center
Efficient Exploration of Diffusion Multiples for Coating Design

09:20 – 09:55 Tresa Pollock, University of Michigan
Ruthenium-Modified Bond Coats for Thermal Barrier Systems

09:55 – 10:30 Carlos Levi, University of California, Santa Barbara
Phase Stability Studies for Thermal Barrier Systems

10:30 – 11:00 Coffee Break

11:00 – 12:00 **Roundtable Discussion: Inter-diffusion and Phase Stability Issues**

12:00 – 13:30 Lunch

Session VII: Non-Destructive Evaluation and Future Coatings

13:30 – 14:05 Alan Atkinson, Imperial College, London
Piezo-spectroscopy Studies of TGO Stress and Damage Evolution

14:05 – 14:40 Ping Xiao, University of Manchester
Impedance Spectroscopy of TBCs

14:40 – 15:15 Maria Arana Antello, ALSTROM, Switzerland
Geometrical and Loading Conditions Affecting TBC Failure

15:15 – 15:30 Coffee Break

15:30 – 16:05 Joerg Feist, Southside Thermal Sciences
Designing "Smart" TBCs: Rare-Earth Activated Materials

16:05 – 16:40 Wolfgang Pompe, Technical University of Dresden
TBCs for Novel Applications

Thursday, 21st August 2003 (continued)

16:45 – 18:00 **Roundtable Discussions on NDE and Lifetime Predictions**

18:00 – 19:00 **Organ Recital**

19:00 – 22:00 Conference Banquet and Social Hour

Friday, 22nd August 2003

07:00 – 08:15 Breakfast

08:30 – 10:30 **Late Breaking Developments and Additional Discussions**

10:30 – 11:00 Coffee Break and Departures

POSTER CONTRIBUTIONS

Bernd Baufeld, German Aerospace Center (DLR), Germany

Influence of Bond-Coat Rumpling on Evolution of Delamination Cracks

Eric Jordan, University of Connecticut

Measurement of Oxide Stress and Associated Failure Modes

Reita Valerie, University Pierre et Marir Curie

Thermal Characterization of New Generation Coatings by "Mirage" Effect

Takashi Goto, Institute for Metals Research, Tohoku University

High-Speed Deposition of YSZ Coatings by Laser CVD

Shunkichi Ueno, National Institute of Advanced Industrial Science and Technology

High temperature Water Vapor Corrosion Resistance of Silicon Nitride with Lu-Si-O EBC

Matvei Zinkevich, Max Planck Institut fur Metallforschung, Stuttgart

Computational Phase Studies

Franziska Traeger, Forschungszentrum, Julich

Fracture Mechanical Model for the Life-Time Evaluation of Plasma-Sprayed TBCs

Doni Jayaseelan, Synergy Materials Research Center, AIST

Development of New Candidate EBC Materials

Xijia Wu, Institute for Aerospace Research, National Research Council, Canada

Microstructural Damage Evolution in a Plasma Sprayed TBC

Gilles Cardosi, ONERA

Stress State in a EB-PVD Thermal Barrier Coating

Yasuo Matsunaga, Japan Fine Ceramics Center

Oxidation Behavior of Bond Coatings for EB-PVD TBCs

Mineaki Matsumoto, Japan Fine Ceramics Center

EB-PVD TBC with Low Thermal Conductivity and High-temperature Stability

John Nychka, University of California, Santa Barbara

Quantifying Cation Grain Boundary Diffusion in Thermally Grown Alumina

Shuqi Guo, Shijie Zhu and Yutaka Kagawa, Institute of Industrial Science, U. Tokyo

Effect of Loading Rate and Hold Time on Hardness and Young's Modulus of EB-PVD Thermal Barrier Coatings

Toru Tomimatsu, Shijie Zhu and Yutaka Kagawa, Institute of Industrial Science, The University of Tokyo,

Local Stress Distribution in Thermally Grown Oxide Layers of EB-PVD Thermal Barrier Coatings