

Preliminary Program

(May 19f, 2022)

THERMAL AND ENVIRONMENTAL BARRIER COATINGS VI

June 19-24, 2022

**Irsee, Germany
Kloster Irsee**

Conference Co-Chairs

Brian Hazel
Pratt & Whitney, USA

Uwe Schulz
German Aerospace Center, Germany

Mike Maloney (retired)
Pratt & Whitney, USA

Robert Vassen
Research Center, Julich, Germany

Ram Darolia (retired)
GE Aviation, USA



Engineering Conferences International
32 Broadway, Suite 314 - New York, NY 10004, USA
www.engconfintl.org – info@engconfintl.org

Sunday, June 19, 2022

16:00 – 18:00 Conference Check-In

18:00 – 19:00 Garden Gathering

19:00 – 21:00 Dinner

21:00 – 22:00 Reception

Monday, June 20, 2022

- 07:00 – 08:15 Breakfast
- 08:15 – 08:30 **Conference Overview**
Brian Hazel, Pratt & Whitney, USA
- Session: Overview of TBC/EBC Application**
Chairs: Gyn Brewster, Rolls-Royce plc., United Kingdom
- 08:30 – 09:00 **Requirements and Design Constraints for TBC's in Land Based Gas Turbines**
Grégoire Witz, Siemens Energy, Switzerland
- 09:00 – 09:30 **Successes, Challenges and Opportunities for Environmental Barrier Coatings**
Don Lipkin, GE-GRC, USA
- 09:30 – 10:00 Coffee Break
- Session: EBCs for Novel Alloy Systems**
Chairs: Uwe Schulz, DLR - German Aerospace Center, Germany
- 10:00 – 10:30 **New Environmental-Thermal Barrier Coatings for Ultrahigh Temperature Alloys**
Ji-Cheng Zhao, University of Maryland, USA
- 10:30 – 11:00 **High Temperature Refractory Metal Alloys-advances and Challenges**
John Perepezko, University of Wisconsin-Madison, USA
- 11:00 – 11:30 **High Entropy Rare Earth Oxide (HERO) Environmental Barrier Coatings for Refractory Metal Alloys**
Elizabeth Opila, University of Virginia, USA
- 11:30 – 12:00 **Selective Thermal Emission Coatings for Improved Turbine Efficiency**
Pete McGrail, Pacific Northwest National Lab, USA
- 12:00 – 13:30 **Lunch**
- Session: EBCs for Novel Alloy Systems (continued)**
Chairs: Uwe Schulz, DLR - German Aerospace Center, Germany
- 13:30 – 14:00 **Assessing the High Temperature Performance of Refractory Metal Alloys**
Bruce Pint, Oak Ridge National Laboratory, USA
- Session: EBC**
Chairs: Sanjay Sampath, Stony Brook University, USA
- 14:00 – 14:30 **EBC Development and Behaviour Analysis for High Temperature CMC Components**
Lisa Pin, Safran Ceramics, France
- 14:30 – 15:00 **Concepts for Enhancing the Life of Environmental Coatings Systems**
Jeroen Deijkers, University of Virginia, USA
- 15:00 – 15:30 Coffee Break

Monday, June 20, 2022 (continued)

- 15:30 – 16:00 **Cyclic Oxidation of Yttrium/Ytterbium Disilicate Environmental Barrier Coatings**
Mackenzie Ridley, ORNL, USA
- 16:00 – 16:30 **Processing and Characterisation of Ytterbium Silicate Environmental Barrier Coatings**
Ping Xiao, University of Manchester, United Kingdom
- 16:30 – 17:00 **Damage Mechanism of an Environmental Barrier Coated Ceramic Matrix Composite Under Thermal and Mechanical Loadings**
Thibaut Archer, ONERA, France
- 17:00 – 18:00 **Discussion**
Leader: Matthew Begley, University of California, Santa Barbara, USA
- 18:30 – 21:30 Dinner & Social Hour

Tuesday, June 21, 2022

- 07:00 – 08:30 Breakfast
- Session: EBC (continued)**
Chairs: Sanjay Sampath, Stony Brook University, USA
- 08:30 – 09:00 **Stabilization Mechanism and CMAS Corrosion Behavior of Rare Earth Oxides Based Environmental Barrier Coatings Prepared by Thermal Spray**
Naoki, Yamazaki, IHI, Japan
- Session: TBC**
Chairs: Gopal Dwivedi, Stony Brook University, USA
- 09:00 – 09:30 **Factors Influencing the Performance of Zirconia Based Thermal Barrier Coatings**
Robert Vaßen, Research Center, Jülich, Germany
- 09:30 – 10:00 **Materials Design to Minimize Radiative Heat Flux Through Coatings**
David Clarke, Harvard University, USA
- 10:00 – 10:30 Coffee Break
- 10:30 – 11:00 **A Mechanism-Based Approach for Assessing the Structural Integrity of Plasma-Sprayed Multilayer Thermal Barrier Coatings**
Matthias Oechsner, University of Darmstadt, Germany
- 11:00 – 11:30 **Thermo-Mechanical Analysis of Blister Damage in Eb-pvd Tbc System: Experiments and Modeling**
Vincent Maurel, Mines ParisTech PSL Research University, France
- 11:30 – 12:00 **Degradation of Aluminide Type Bondcoats Due to Oxidation and Interdiffusion: Effect of Base Alloy Composition**
Dmitry Naumenko, Forschungszentrum Jülich, Germany
- 12:00 – 13:30 Lunch
- Session: TBC/EBC Processing**
Chairs: Robert Vaßen, Research Center, Jülich, Germany
- 13:30 – 14:00 **Microstructure, Phase Formation and Cyclic Behavior of PVD-based Y-silicate Environmental Barrier Coatings for SiC-SiC CMC**
Uwe Schulz, DLR - German Aerospace Center, Germany
- 14:00 – 14:30 **Multilayer TBCs and EBCs: Integrating Design and Manufacturing Innovations for Multifunctional Performance**
Sanjay Sampath, Stony Brook University, USA
- 14:30 – 15:00 **Microstructure and Phase Composition Evolution of Thermal Sprayed Yb-Silicate Coatings during Post Heat Treatment and Burner Rig Test**
Emine Bakan, Forschungszentrum Jülich GmbH, Germany
- 15:00 – 15:30 Coffee Break
- 15:30 – 16:00 **Thermal Barrier Coatings on Additive Manufactured Superalloy Parts?**
Nicolaie Markocsan, University West, Sweden

Tuesday, June 21, 2022 (continued)

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| 16:00 – 16:30 | Plasma-activated EB-PVD of Protective Coatings: Tools and Processes
Burkhard Zimmerman, Fraunhofer FEP, Germany |
| 16:30 – 17:00 | Comparative Study of Thermal Barrier Coatings by S-hvof and Eb-pvd Process
Yoshifumi Okajima, Mitsubishi Heavy Industries, Ltd., Japan |
| 17:00 – 18:00 | Discussion
Leader: Don Lipkin, GE-GRC, USA |
| 18:00 – 19:30 | Dinner |
| 19:30 – 21:30 | Poster Session & Social Hour |

Wednesday, June 22, 2022

- 07:00 – 08:30 Breakfast
- Session: TBC/EBC Processing**
Chairs: Vincent Maurel, Mines ParisTech PSL Research University, France
- 08:30 – 09:00 **Columnar Thermal Barrier Coatings Manufactured by Novel Laser Cladding Process**
Mack Daniel, Forschungszentrum Juelich, Germany
- 09:00 – 09:30 **Solution Precursor Plasma Spray Applied to Turbine Components, Challenges and Engine Test Results**
Eric Jordan, University of Connecticut, USA
- 09:30 – 10:00 **New Enhanced Technical Capabilities of the ALD SMARTcoater**
Ole Hinrichs, ALD Vacuum Technologies GmbH, Germany
- 10:00 – 10:30 Coffee Break
- 10:30 – 11:00 **The Synthesis of EBC Layer Stacks by the Combination of PVD and CVD in a Continuous Vacuum Process**
Jürgen Ramm, Oerlikon Surface Solutions AG ZN Balzers, Liechtenstein
- Session: Properties and Testing**
Chairs: David Clarke, Harvard University, USA
- 11:00 – 11:30 **Simulations of Oxide Growth and Stress Evolution in Silicon-based Coatings and Composites**
Matt Begley, University of California, USA
- 11:30 – 12:00 **Surface Properties Characterization of Advanced Thermal and Environmental Barrier Coatings Interaction with CMAS**
Anindya Ghoshal, US Army Research Lab, USA
- 12:00 – 13:30 Lunch
- Session: Properties and Testing (continued)**
Chairs: David Clarke, Harvard University, USA
- 13:30 – 14:00 **Experimental Measurements of Mode-II Interfacial Toughness in Two Commercial Thermal Barrier Coating Systems**
Kevin Hemker, Johns Hopkins University, USA
- 14:00 – 14:30 **Thermal Transient Effects on TBC Durability**
Wes Jackson, Raytheon Technologies Research, USA
- 14:30 – 15:00 Coffee Break
- 15:00 – 15:30 **Micromechanical Testing of Thermal Barrier Coatings**
Ying Chen, The University of Manchester, United Kingdom
- 15:30 – 16:00 **Assessment of Mechanical TBC Failure in Complex Geometries**
Mario Rudolphi, DECHEMA-Forschungsinstitut, Germany

Wednesday, June 22, 2022 (continued)

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| 16:00 – 16:30 | Intrinsic and Extrinsic Failure Of Thermal Barrier Coatings and Thermal Conductivity Evolution Under Adverse Environments: Towards an Integrated Modeling
Kuiying Chen, National Research Council Canada, Canada |
| 16:30 – 17:30 | Discussion
Leader: David Poerschke, University of Minnesota, USA |
| 17:30 – 18:00 | TBD |
| 19:30 – 20:00 | Reception |
| 20:00 | Conference Dinner |

Thursday, June 23, 2022

07:00 – 08:30 Breakfast

Session: CMAS

Chairs: Elizabeth Opila, University of Virginia, USA

08:30 – 09:00 **Understanding the Stability of Mixed-Anion Deposits and Effects on Reactions with Advanced Coating Materials**
David Poerschke, University of Minnesota, USA

09:00 – 09:30 **Understanding Silicate Deposit Variability and its Implications for Evaluating TBCs and EBCs**
Andrew Ericks, University of California, Santa Barbara, USA

09:30 – 10:00 **A Geoscientific Perspective on Silicate Melt Interactions with TBCs**
Dirk Müller, LMU Munich, Germany **DECLINED**

10:00 – 10:30 Coffee Break

Student Presentations

Chair: Brian Hazel, Pratt & Whitney, USA

10:30 – 10:45 Student Presentation 1

10:45 – 11:00 Student Presentation 2

11:00 – 11:15 Student Presentation 3

11:15 – 11:30 Student Presentation 4

11:30 – 12:00 **Discussion**
Leader: Kevin Hemker, Johns Hopkins University, USA

12:00 – 13:30 Lunch

13:30 – 18:30 **Kaufbeuren Excursion**

18:30 – 21:30 Dinner & Social Hour

Friday, June 24, 2022

07:00 – 08:30 Breakfast

Session: CMAS (continued)

Chairs: Molly O'Connor, Praxair Surface Technologies, USA

08:30 – 09:00 **Expectations and Realities of CMAS Mitigation**
Vladimir Tolpygo, Honeywell, USA

09:00 – 09:30 **Reactions in Thermal Barrier Coatings and Multi-Mineral Dusts in a Gas Turbine Engine Dust Ingestion Test**
Gyn Brewster, Rolls Royce, USA

09:30 – 10:00 **CMAS Reactive Coatings for TBCs**
Margaux Wallace, General Electric Global Research, USA

10:00 – 10:30 Coffee Break

10:30 – 11:00 **Development of CMAS Resistant Thermal Barrier Coatings: Challenges and Implications**
Ravisankar Naraparaju, DLR, Germany

11:00 – 11:30 **Corrosion of E/TBCs: Chemical Interactions of Ceramic Materials with CMAS**
Pierre-Jean Panteix, University of Lorraine, France

11:30 – 12:30 **Discussion**
Leader: Mike Maloney, Pratt & Whitney, USA

12:30 – 14:00 Lunch

14:00 Departure