Program

THERMAL AND ENVIRONMENTAL BARRIER COATINGS VI

June 19 - 24, 2022

Irsee, Germany
Kloster Irsee

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Previous conferences in this series:

Thermal and Environmental Barrier Coatings
Aug 17-22, 2003
Irsee, Germany
Conference Chairs:
David R. Clarke, University of California Santa Barbara, USA
Anthony Evans, Princeton University, USA
Manfred Ruehle, MPI, Germany

Thermal Barrier Coatings II
August 12-17, 2007
Irsee, Germany
Conference Chairs:
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Kevin Hemker, Johns Hopkins University, USA
Christoph Leyens, Technical University of Brandenburg at Cottbus, Germany
Yutaka Kagawa, University of Tokyo, Japan

Thermal Barrier Coatings III
Aug. 7-12, 2011
Irsee, Germany
Conference Chairs:
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Uwe Schulz, German Aerospace Center, Germany
David Rickerby, Rolls-Royce, UK
Ram Darolia, GE Aviation, USA
Odile Lavigne, ONERA DMSM/MAT, France
Hideyuki Murakami, National Institute of Materials Science, Japan
Hongbo Guo, Beihang University, China

Thermal Barrier Coatings IV
June 22-27, 2014
Irsee, Germany
Conference Chairs:
Uwe Schulz, German Aerospace Center, Germany
Ram Darolia, GE Aviation, USA
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Thermal Barrier Coatings V
June 24 – 29, 2018
Irsee, Germany
Conference Chairs:
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		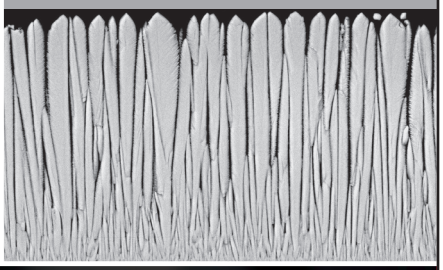

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COMMITMENT

We are proud to support ECI's Thermal and Environmental Barrier Coatings Conference VI.

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Sunday, June 19, 2022

16:00 – 18:00	Conference Check-In (Room 102)
18:00 – 22:00	Garden Gathering including reception, BBQ dinner and music by BauernStreichwurst

Locations and Notes

- *Poster Sessions will be in the corridor near the meeting room.*
- *We will have as many meals outside as possible, weather permitting.*
- *Please wear your mask except when giving a presentation or actively eating or drinking. Please maintain physical distancing as much as possible.*
- *Audio, still photo and video recording by any device (e.g., cameras, cell phones, laptops, PDAs, watches) is strictly prohibited during the technical sessions, unless the author and ECI have granted prior permission.*
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- *Please do not smoke at any conference functions.*
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Monday, June 20, 2022

07:00 – 08:15	Breakfast
08:15 – 08:30	**Conference Overview** Brian Hazel, Pratt & Whitney, USA
	ECI welcome: Ram Darolia (GE Aviation, retired)
	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** Julie Kuhn, GE Aviation, 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

Monday, June 20, 2022 (continued)

15:00 – 15:30	Coffee Break
15:30 – 16:00	**Processing and Characterization of Ytterbium Silicate Environmental Barrier Coatings** Ping Xiao, University of Manchester, United Kingdom
16:00 – 16:30	**Damage Mechanism of an Environmental Barrier Coated Ceramic Matrix Composite Under Thermal and Mechanical Loadings** Thibaut Archer, ONERA, France
16:30 – 17:00	**The Synthesis of EBC Layer Stacks by the Combination of PVD and CVD in a Continuous Vacuum Process** Jurgen Ramm, Oerlikon Surface Solutions AG ZN Balzers, Liechtenstein
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 (Summer Solstice)

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
09:00 – 09:30	**Cyclic oxidation of yttrium/ytterbium disilicate environmental barrier coatings** Bruce Pint, Oak Ridge National Laboratory, USA
	Session: TBC Chairs: Grégoire Witz, Seimens Energy, Switzerland
09:30 – 10:00	**Factors influencing the performance of zirconia based thermal barrier coatings** Robert Vaβen, Forschungszentrum Julich GmbH, Germany
10:00 – 10:30	Coffee Break
10:30 – 11:00	**A Coupled Thermal and Mechanical Analysis of Sintering in Thermal Barrier Coatings Under Gradient Exposure** John Saputo, Stony Brook University, USA
11:00 – 11:30	**A mechanism-based approach for assessing the structural integrity of plasma-sprayed multilayer thermal barrier coatings** Matthias Oechsner, University of Darmstadt, Germany
11:30 – 12:00	**Thermo-mechanical Analysis of Blister Damage in Eb-pvd Tbc System: Experiments and Modeling** Vincent Maurel, Mines Paris PSL University – Centre des Materiaux UMR CNRS 7633, France
12:00 – 13:30	Lunch
	Session: TBC (continued) Chairs: Grégoire Witz, Seimens Energy, Switzerland
13:30 – 14:00	**Degradation of aluminide type bondcoats due to oxidation and interdiffusion: effect of base alloy composition** Dmitry Naumenko, Forschungszentrum Juelich GmbH, Germany
14:00 – 14:30	**Novel multicomponent equiatomic pyrochlores for future thermal barrier coatings** Maren Lepple, JLU Gießen, Germany
	Session: TBC/EBC Processing Chairs: Robert Vaβen, Research Center, Julich, Germany
14:30 – 15:00	**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

Tuesday, June 21, 2022 (continued)

15:00 – 15:30	Coffee Break
15:30 – 16:00	**Multilayer TBCs and EBCs: Integrating Design and Manufacturing Innovations for Multifunctional Performance** Sanjay Sampath, Stony Brook University, USA
16:00 – 16:30	**Microstructure and Phase Composition Evolution of Thermal Sprayed Yb-Silicate Coatings during Post Heat Treatment and Burner Rig Test** Emine Bakan, Forschungzentrum Jülich GmbH, 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: Brian Stephens, GE Aviation, 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 (continued) Chairs: Molly O'Connor, Praxair Surface Technologies, USA
08:30 – 09:00	**Columnar Thermal Barrier Coatings Manufactured by Novel Laser Cladding Process** Daniel Mack, Forschungszentrum Jülich, Germany
09:00 – 09:30	**Thermal Barrier Coatings on Additive Manufactured Superalloy Parts** Nicolaie Markocsan, University West, Sweden
09:30 – 10:00	**Plasma-activated EB-PVD of protective coatings: tools and processes** Burkhard Zimmerman, Fraunhofer FEP, Germany
10:00 – 10:30	Coffee Break
10:30 – 11:00	**Investigating the microstructure of as-sprayed high-crystalline Yb2Si2O7 environmental barrier coating (EBC) deposited by atmospheric plasma spray (APS)** Christian Moreau, Concordia University, Canada
11:00 – 11:30	**New Enhanced Technical Capabilities of the ALD SMARTcoater** Ole Hinrichs, ALD Vacuum Technologies GmbH, Germany
11:30 – 12:00	**Cathodic Arc Evaporation of MCrALY Coatings** Sebastien Guimond, Oerlikon Surface Solutions AG, Liechtenstein
12:00 – 13:30	Lunch
	Session: Properties and Testing Chairs: Bruce Pint, Oak Ridge National Laboratory, USA
13:30 – 14:00	**Simulations of Oxide Growth and Stress Evolution in Silicon-based Coatings and Composites** Matt Begley, University of California, USA
14:00 – 14:30	**Micromechanical Testing of Thermal Barrier Coatings** Ying Chen, The University of Manchester, United Kingdom
14:30 – 15:00	**Assessment of Mechanical TBC Failure in Complex Geometries** Mario Rudolphi, DECHEMA-Forschungsinstitut, Germany
15:00 – 15:30	**Synthesis and characterization of compositionally complex zirconate and phosphates** Daniel Mumm, University of California, Irvine, USA
15:30 – 16:00	Coffee Break
16:00 – 17:00	**Discussion** Leader: David Poerschke, University of Minnesota, USA
17:00 – 17:30	**Future engine challenges for TBCs/EBCs** Frank Preli, Pratt & Whitney, USA

Wednesday, June 22, 2022 (continued)

19:30 – 20:00	Reception
20:00	Conference Dinner with music by VolXmucke

Thursday, June 23, 2022

07:00 – 08:30	Breakfast
	Session: CMAS Chairs: Elizabeth Opila, University of Virginia, USA
08:30 – 09:00	**E 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	**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	**A Geoscientific Perspective on Silicate Melt Interactions with TBCs** Dirk Müller, LMU Munich, Germany
10:00 – 10:30	Coffee Break
	Student Presentations Chair: Brian Hazel, Pratt & Whitney, USA
10:30 – 10:45	**Understanding garnet phase stability in Gd/Y/Yb-CMAS systems and influences on multiphase T/EBC-CMAS interactions** Eeshani Paresh Godbole, University of Minnesota, USA
10:45 – 11:00	**Microstructure modification of EB-pvd gadolinium zirconate thermal barrier coatings and the effect on their resistance against siliceous CMAS melts** Christoph Mikulla, German Aerospace Center (DLR), Germany
11:00 – 11:15	**Mechanical properties of Yb2Si2O7 coatings prepared using electrophoretic deposition** Esma Yilmaz, University of Manchester, United Kingdom
11:15 – 11:30	**Simultaneous residual stress mapping of topcoat and TGO in APS TBC using combined micro-raman-PL spectroscopy** Srikanth Batna, Indian Institute of Technology Bombay, India
11:30 – 12:00	**Discussion** Leader: Ravisankar Naraparaju, DLR – German Aerospace Center, Germany
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: Vincent Maurel, Mines Paris PSL University – Centre des Materiaux UMR CNRS 7633, France
08:30 – 09:00	**Understanding Silicate Deposit Variability and its Implications for Evaluating TBCs and EBCs** Andrew Ericks, University of California, Santa Barbara, USA
09:00 – 09:30	**CMAS Reactive Coatings for TBCs** Margeaux Wallace, General Electric Global Research, USA
09:30 – 10:00	**Development of CMAS Resistant Thermal Barrier Coatings: Challenges and Implications** Ravisankar Naraparaju, DLR, Germany
10:00 – 10:30	Coffee Break
10:30 – 11:00	**Corrosion of E/TBCs: Chemical Interactions of Ceramic Materials with CMAS** Pierre-Jean Panteix, University of Lorraine, France
11:00 – 12:00	**Discussion** Leader: Mike Maloney, Pratt & Whitney, USA
12:00 – 13:30	Lunch
13:30	Departures

Poster Presentations

1. **Influence of alumina addition on steam corrosion behaviour of Ytterbium disilicates for EBC applications**
   Ahmet Hilmi Paksoy, The University of Manchester, United Kingdom

2. **Reactions of rare earth hafnates and zirconates with silicate melts of different basicity**
   Andrew R. Ericks, University of California, Santa Barbara, USA

3. **Debye-Larmor high enthalpy cascade plasma gun technology to apply ceramic coatings for the turbine industry**
   Armando Salito, Gulhfi Consulting AG, Switzerland

4. **TUBA Nova - A novel industrial EB-PVD coater platform for state-of-the-art TBCs and multi-layer coatings**
   Carsten Deus, VON ARDENNE GmbH, Germany

5. **Investigating the microstructure of as-sprayed high-crystalline Yb2Si2O7 environmental barrier coating (EBC) deposited by atmospheric plasma spray (APS)**
   Christian Moreau, Concordia University, Canada

6. **Microstructure modification of EB-pvd gadolinium zirconate thermal barrier coatings and the effect on their resistance against siliceous CMAS melts**
   Christoph Mikulla, German Aerospace Center (DLR), Germany

7. **Thermal Environmental Barrier Coatings (TEBCs), and their deposits-induced degradation and Its mitigation**
   Christopher Louzon, Brown University, USA

8. **Synthesis of multi component rare-earth silicate systems for T/EBC application: Study of their high temperature interactions with CMAS**
   Cynthia Yanel Guijosa Garcia, German Aerospace Center (DLR), Germany

9. **Environmental barrier coatings deposited by suspension plasma spraying**
   Dapeng Zhou, Forschungszentrum Jülich GmbH, Germany

10. **Understanding garnet phase stability in Gd/Y/Yb-CMAS systems and influences on multiphase T/EBC-CMAS interactions**
    Eeshani Paresh Godbole, University of Minnesota, USA

11. **Mechanical properties of Yb2Si2O7 coatings prepared using electrophoretic deposition**
    Esma Yilmaz, University of Manchester, United Kingdom

12. **Ytterbium silicate environmental barrier coatings prepared by a novel slurry spraying-reactive sintering technique**
    Gauri Waghmare, Indian Institute of Technology Bombay, India

13. **Concepts for enhancing the life of environmental coatings systems**
    Jeroen Deijkers, University of Virginia, USA

14. **Coatings for increased efficiency in compression ignition engines**
    John Saputo, Stony Brook University, Center for Thermal Spray Research, USA

15. **A coupled thermal and mechanical analysis of sintering in thermal barrier coatings under gradient exposure**
John Saputo, Stony Brook University, Center for Thermal Spray Research, USA

16. **Effects of EB-PVD microstrural features on CMAS infiltration of Yttria-rich zirconia coatings**
Juan Gomez, Pratt & Whitney, USA

17. **Thermochemical stability of high entropy rare earth oxide (HERO) coatings for refractory alloys**
Kristyn Ardrey, University of Virginia, USA

18. **Spatially resolved characterization of thermally grown oxides using time-domain thermoreflectance**
Milena Milich, University of Virginia, USA

19. **Emerging coating materials for H2 powered turbines**
Molly O'Connor, Praxair Surface Technologies, USA

20. **A study of the of ytterbium disilicates undergoing water vapour corrosion for environmental barrier coating applications**
Simon McCormack, University of Manchester, United Kingdom

21. **Simultaneous residual stress mapping of topcoat and TGO in APS TBC using combined micro-raman-PL spectroscopy**
Srikanth Batna, Indian Institute of Technology Bombay, India

22. **Lessons learned in design and characterization of EBC spray powders**
Ursa Pirnat, Treibacher Ind. AG, Austria

23. **A comparative study of phase evolution in YSZ powders, pellets and free-standing air plasma sprayed thermal barrier coatings**
Vikram Hastak, Indian Institute of Technology Bombay, India

24. **SiC-based/EBC Coating systems investigated by LASAT (LAser Shock Adhesion Test)**
Vincent Guipont, MINES Paris - PSL / Centre des Matériaux (CNRS 7633), France

25. **Non-destructively capturing CMAS degradation of EB-PVD thermal barrier coatings through 3D confocal Raman renderings**
Zachary Stein, University of Central Florida, USA

26. **The utilization of laser thermal testing with thermographic measurement for TBC lifetime performance evaluation**
Zdeněk Veselý, University of West Bohemia, Czech Republic