



From the Basic Understanding of Corrosion Mechanisms to the Modeling of Multi Layered or Multi-Materials Systems Under Complex Multiphysics Loading

July 9 - 14, 2017

Chair

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Conference Description

The understanding of the reactivity between functional or structural materials with their environment at high temperature is a key of progress for many industrial applications. This understanding needs to be taken into account in the design of new alloys, composites and systems. It allows the materials optimization and the quantitative prediction of their behavior and lifetime. Therefore, it is essential to the optimization of the use of raw materials and energy resources. High temperature corrosion is a very complex science dealing with gas, solids and sometimes liquids. All aspects of the phenomena need to be taken into account, including thermodynamics, transport phenomena, reaction kinetics, mechanical behavior and multiphysical couplings. Moreover, industrial applications often deal with complex gas mixtures, sometimes out of equilibrium, and complex materials with more than 10 chemical species and varying microstructures. Therefore a wide range of studies is necessary from the atomic to the macroscopic scale, on both model and complex systems. Current issues include the understanding of corrosion mechanisms in aggressive environments including hot corrosion, carburization and metal dusting, corrosion in mixed oxidants, water vapor and supercritical fluids. Interactions with mechanical loading and other physical properties need to be assessed. The way to use this knowledge in high temperature materials development, protection solutions -including coating developments-, time of life modelling and recycling solutions, building of databases and the prediction of corrosion behavior from many parameters in complex systems needs to be improved. New manufacturing processes, especially from powders, and for

example, additive manufacturing brings new areas of study with emphasis on the effect of alloy microstructure, segregations, internal stresses and surface roughness. The development of new characterization and modelling tools allows opportunities to revisit older knowledge and to open new research areas. The objective of the conference is to present the most recent findings in the fundamental understanding of both simple and complex systems, making use of the most recent advances in material characterization and modelling. The lecture speakers are all invited. They are chosen for their expertise, recent research advances, and novelty of approach. The lectures are provided with extensive time for discussion in morning and evening, and the late afternoon and evening is for poster sessions. All delegates are encouraged to submit posters on their own work in order to facilitate a lively exchange of information. All stay in college dormitories, have meals together, and socialize during the free periods in the afternoon and the late evening. This environment provides an international and diverse forum for scientific discussion, to develop innovative ideas. This GRC format is particularly beneficial for graduate students and other young researchers because of the ready access to the leaders in the field from around the world. Moreover, the 2017 GRC will be preceded by the High Temperature Corrosion Gordon Research Seminar (GRS) for graduate students and postdoctoral scientists, in order to encourage early career researchers in this field.

Related Meeting



This GRC will be held in conjunction with the "High Temperature Corrosion (GRS)" Gordon Research Seminar (GRS). Those interested in attending both meetings must submit an application for the GRS in addition to an application for the GRC. Refer to the [associated GRS program page](#) for more information.

Conference Program

Sunday	
2:00 pm - 9:00 pm	Arrival and Check-in
6:00 pm - 7:00 pm	Dinner
7:30 pm - 7:40 pm	Introductory Comments by GRC Site Staff / Welcome from the GRC Chair
7:40 pm - 9:30 pm	Elementary Mechanisms of High Temperature Corrosion and Their Modelling Discussion Leader: Mitsutoshi Ueda (Tokyo Institute of Technology, Japan)

7:40 pm - 7:45 pm	Introduction by Discussion Leader
7:45 pm - 8:25 pm	David Young (University of New South Wales, Australia) "Do Foreign Species like H ₂ O or CO ₂ Affect Internal Oxidation? The Interesting Case of Fe-Ni Base Alloys in Mixed Gases"
8:25 pm - 8:40 pm	Discussion
8:40 pm - 9:20 pm	Rishi Pillai (Forschungszentrum Juelich GmbH, Germany) "Thermodynamic and Kinetic Modelling to Predict Oxidation Induced Degradation in Nickel Base Superalloy Components: Opportunities and Limitations"
9:20 pm - 9:30 pm	Discussion

Monday

7:30 am - 8:30 am	Breakfast
9:00 am - 12:30 pm	Corrosion and Multiphysics Coupling Discussion Leader: Peter Tortorelli (Oak Ridge National Laboratory, USA)
9:00 am - 9:20 am	Introduction by Discussion Leader
9:20 am - 10:00 am	John Nicholls (Cranfield University, United Kingdom) "High Temperature Corrosion Under Cyclically Loaded Conditions"
10:00 am - 10:30 am	Discussion
10:30 am - 11:00 am	Coffee Break
11:00 am - 11:40 am	Philippe Marcus (Chimie ParisTech, CNRS, France) "Recent Advances in <i>In Situ</i> Studies of Oxidation: Diffusion Measurements Using Oxygen Isotopes and Oxidation Experiments Under Stress in a ToF-SIMS Spectrometer"
11:40 am - 12:10 pm	Discussion
12:10 pm - 12:30 pm	General Discussion
12:30 pm - 1:30 pm	Lunch
1:30 pm - 4:00 pm	Free Time

3:00 pm - 4:00 pm	<p>Power Hour</p> <p><i>The GRC Power Hour is an optional informal gathering open to all meeting participants. It is designed to help address the challenges women face in science and support the professional growth of women in our communities by providing an open forum for discussion and mentoring.</i></p> <p>Organizer: Elizabeth Opila (University of Virginia, USA)</p>
4:00 pm - 6:00 pm	Poster Session
6:00 pm - 7:00 pm	Dinner
7:30 pm - 9:30 pm	<p>New Materials, New Processes</p> <p>Discussion Leader: Sebastien Chevalier (Université Bourgogne Franche-Comté, France)</p>
7:30 pm - 7:35 pm	Introduction by Discussion Leader
7:35 pm - 8:15 pm	<p>Sebastien Dryepondt (Oak Ridge National Laboratory, USA)</p> <p>"Optimization of the Oxidation and Mechanical Behaviors of Ni-Based Superalloys Fabricated by Additive Manufacturing"</p>
8:15 pm - 8:35 pm	Discussion
8:35 pm - 9:15 pm	<p>Todd Butler (Air Force Research Laboratory, USA)</p> <p>"Recent Developments on the High Temperature Oxidation Behavior of High-Entropy Alloys"</p>
9:15 pm - 9:30 pm	Discussion
Tuesday	
7:30 am - 8:30 am	Breakfast
9:00 am - 12:30 pm	<p>Corrosion in Energy Conversion Systems</p> <p>Discussion Leader: Gerald Meier (University of Pittsburgh, USA)</p>
9:00 am - 9:20 am	Introduction by Discussion Leader
9:20 am - 10:00 am	<p>Jan Froitzheim (Chalmers University of Technology, Sweden)</p> <p>"Material Challenges for Ferritic Stainless Steels in SOFC/SOEC Environments"</p>
10:00 am - 10:30 am	Discussion

10:30 am - 11:00 am	Group Photo / Coffee Break
11:00 am - 11:40 am	Bruce Pint (Oak Ridge National Laboratory, USA) "The Effect of Pressure and Thermal Cycling on the Compatibility of Structural Alloys in Supercritical CO ₂ "
11:40 am - 12:10 pm	Discussion
12:10 pm - 12:30 pm	General Discussion
12:30 pm - 1:30 pm	Lunch
1:30 pm - 4:00 pm	Free Time
4:00 pm - 6:00 pm	Poster Session
6:00 pm - 7:00 pm	Dinner
7:30 pm - 9:30 pm	Understanding and Modeling Complexity Discussion Leader: Michael Schuetze (DECHEMA-Forschungsinstitut, Germany)
7:30 pm - 7:35 pm	Introduction by Discussion Leader
7:35 pm - 8:15 pm	Brian Gleeson (University of Pittsburgh, USA) "An Experimentalist's Approach to Using Materials Computation as a Tool for Understanding and Predicting Oxidation Phenomena"
8:15 pm - 8:35 pm	Discussion
8:35 pm - 9:15 pm	Elizabeth Opila (University of Virginia, USA) "Fundamental Mechanisms and Models for Environmental Barrier Coating Degradation"
9:15 pm - 9:30 pm	Discussion
Wednesday	
7:30 am - 8:30 am	Breakfast
9:00 am - 12:30 pm	Materials Design Discussion Leader: Clara Desgranges (Safran, France)
9:00 am - 9:05 am	Introduction by Discussion Leader

9:05 am - 9:45 am	Tomonori Kitashima (National Institute for Materials Science, Japan) "Development of Oxidation-Resistant High-Temperature Ti Alloys"
9:45 am - 10:05 am	Discussion
10:05 am - 10:30 am	Coffee Break
10:30 am - 11:10 am	Alfred Ludwig (Ruhr-University Bochum, Germany) "High-Throughput Investigation of Oxidation and Phase Constitution of Combinatorial Thin-Film Materials Libraries"
11:10 am - 11:30 am	Discussion
11:30 am - 12:10 pm	Prakash Patnaik (National Research Council Canada Aerospace, Canada) "Understanding High Temperature Coating Failures in Gas Turbines"
12:10 pm - 12:30 pm	Discussion
12:30 pm - 1:30 pm	Lunch
1:30 pm - 4:00 pm	Free Time
4:00 pm - 6:00 pm	Poster Session
6:00 pm - 7:00 pm	Dinner
7:00 pm - 7:30 pm	Business Meeting <i>Nominations for the Next Vice Chair; Fill in Conference Evaluation Forms; Discuss Future Site and Scheduling Preferences; Election of the Next Vice Chair</i>
7:30 pm - 9:30 pm	Characterization Discussion Leader: Gordon Tatlock (University of Liverpool, United Kingdom)
7:30 pm - 7:35 pm	Introduction by Discussion Leader
7:35 pm - 8:15 pm	Krystyna Stiller (Chalmers University of Technology, Sweden) "Grain Boundary Chemistry and Transport in Oxides Using Atom Probe Tomography"

8:15 pm - 8:35 pm	Discussion
8:35 pm - 9:15 pm	Yves Wouters (SIMaP, Université Grenoble Alpes, France) "Semiconducting Properties Imaging of Chromia Scales Thermally Grown Under Controlled Oxygen Partial Pressures"
9:15 pm - 9:30 pm	Discussion
Thursday	
7:30 am - 8:30 am	Breakfast
9:00 am - 12:30 pm	Protection Against Corrosion of Structural and Functional Materials Discussion Leader: Francisco Javier Perez Trujillo (Universidad Complutense de Madrid, Spain)
9:00 am - 9:05 am	Introduction by Discussion Leader
9:05 am - 9:45 am	Mathias Galetz (DECHEMA-Forschungsinstitut, Germany) "Change of NiAl-Diffusion Coatings During Thermocyclic Exposure and Their Impact on the Mechanical Behavior of the Base Material"
9:45 am - 10:05 am	Discussion
10:05 am - 10:30 am	Coffee Break
10:30 am - 11:10 am	Alina Agüero (National Institute of Aerospace Technology (INTA), Spain) "Coatings for Solar Concentration Power Plants Components at High Temperatures"
11:10 am - 11:30 am	Discussion
11:30 am - 12:10 pm	Vladimir Tolpygo (Honeywell Aerospace, USA) "CMAS-Induced Failure of EB-PVD TBC: Not as Simple as It May Seem"
12:10 pm - 12:30 pm	Discussion
12:30 pm - 1:30 pm	Lunch
1:30 pm - 4:00 pm	Free Time

4:00 pm - 6:00 pm	Poster Session
6:00 pm - 7:00 pm	Dinner
7:30 pm - 9:30 pm	New Ways of Teaching and Scientific Opening Discussion Leader: Daniel Monceau (CIRIMAT, CNRS, France)
7:30 pm - 7:35 pm	Introduction by Discussion Leader
7:35 pm - 8:15 pm	Janet Rankin (Massachusetts Institute of Technology, USA) "Research-Based Teaching @ MIT"
8:15 pm - 8:30 pm	Discussion
8:30 pm - 9:10 pm	Julian Ledieu (Institut Jean Lamour, Université de Lorraine, France) "A Tunnel to Tomorrow's Materials: Starting with Complex Metallic Alloy Surfaces"
9:10 pm - 9:25 pm	Discussion
9:25 pm - 9:30 pm	Closing Remarks
Friday	
7:30 am - 8:30 am	Breakfast
9:00 am	Departure

Contributors

		
		
		

