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13. ABSTRACT *(Maximum 200 words)*

The Gordon Research Conference (GRC) on CORROSION-DRY was held at COLBY SWYER 1 from 7/20/97 thru 7/25/97. The Conference was well attended with 125 participants. The attendees represented the spectrum of endeavor in this field coming from academia, industry, and government laboratories, both U.S. and foreign scientists, senior researchers, young investigators, and students.

In designing the formal speakers program, emphasis was placed on current unpublished research and discussion of the future target areas in this field. There was a conscious effort to stimulate lively discussion about the key issues in the field today. Time for formal presentations was limited in the interest of group discussions. In order that more scientists could communicate their most recent results, poster presentation time was scheduled.

The conference is focused on recent advances in understanding the fundamentals of oxidation/corrosion of oxidation-resistant alloys and ceramics, with emphasis on their role in high-temperature applications. Individual sessions are: Oxidation of Non-metallic Materials, Stress in Oxide Scales, Oxidation of TiAl, Thermal Barrier Coatings I, Thermal Barrier Coatings II, Internal Oxidation, Interfacial Processes, High Temperature Corrosion Resistance of Chromia-Formers Interface Instability in Ternary Systems.

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1997 GORDON RESEARCH CONFERENCE
on CORROSION - DRY
FINAL PROGRESS REPORT

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH

GRANT NO. F49620-97-1-0503

The Gordon Research Conference (GRC) on CORROSION - DRY was held at COLBY SAWYER 1 from 7/20/97 thru 7/25/97. The Conference was well-attended with 125 participants (attendees list attached). The attendees represented the spectrum of endeavor in this field coming from academia, industry, and government laboratories, both U.S. and foreign scientists, senior researchers, young investigators, and students.

In designing the formal speakers program, emphasis was placed on current unpublished research and discussion of the future target areas in this field. There was a conscious effort to stimulate lively discussion about the key issues in the field today. Time for formal presentations was limited in the interest of group discussions. In order that more scientists could communicate their most recent results, poster presentation time was scheduled. Attached is a copy of the formal schedule and speaker program and the poster program. In addition to these formal interactions, "free time" was scheduled to allow informal discussions. Such discussions are fostering new collaborations and joint efforts in the field.

I want to personally thank you for your support of this Conference. As you know, in the interest of promoting the presentation of unpublished and frontier-breaking research, Gordon Research Conferences does not permit publication of meeting proceedings. If you wish any further details, please feel free to contact me. Thank you.

Sincerely,

DAVID J YOUNG
UNIVERSITY OF NEW SOUTH WALES

GORDON RESEARCH CONFERENCE

1997

HIGH TEMPERATURE CORROSION

D. J. Young, Chairman

P. Hancock, Poster Session Convenor

Sponsored by:

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Electric Power Research Institute
University of New South Wales, School of Materials Science & Engineering

Introduction

The Gordon Research Conferences were established to foster the open sharing of new scientific findings and theories between researchers in the field. Unlike most other conferences, a full week is dedicated to presentations in one area. The talks and discussions are typically of such a duration to allow in-depth exposition and full discussion of a specific session topic. Speakers are selected by the chairman for their expertise and recent progress in areas deemed to be at the frontiers of science.

Another key aspect of the conference is accessibility. The opportunity for informal discussions outside the lecture program is unique in that attendees stay in college dormitories, have meals together and otherwise socialize in the free afternoon periods or after the evening sessions. There is also the opportunity for attendees to present their own work through poster sessions. This format is particularly helpful for graduate students and new researchers in the field to make personal contacts with established expert and international attendees.

1997 Gordon Research Conference on High-Temperature Corrosion

The conference is focused on recent advances in understanding the fundamentals of oxidation/corrosion of oxidation-resistant alloys and ceramics, with emphasis on their role in high-temperature applications. Individual sessions are

Oxidation of Non-metallic Materials
Stress in Oxide Scales
Oxidation of TiAl
Thermal Barrier Coatings I
Thermal Barrier Coatings II
Internal Oxidation
Interfacial Processes
High Temperature Corrosion Resistance of Chromia-Formers
Interface Instability in Ternary Systems

The speakers have been chose for their unique contributions to and knowledge of their subject areas. For this reason, a number have spoken at previous conferences, but 11 are new speakers.

The session discussion leaders also have a wide background on corrosion and have been selected for their leadership and contributions, their experience with the Gordon Conference format, and their ability to direct a spirited discussion.

Oxidation of Non-Metallic Materials

Silica can give protection to a wide range of materials in oxidising environments, including a number of advanced ceramic materials. It is also the oxide grown on pure silicon in the production of gate devices. These papers are concerned with reaching a fundamental understanding of silica growth in two very different situations, namely the controlled production of very thin silica films and the development of protective silica scales.

Stress in Oxide Scales

The accumulation of mechanical stress in oxide scales as they grow can lead to scale damage and loss of their protective function. These papers are concerned with respectively, the experimental measurement of stress within the scale and a fracture-mechanics approach to the prediction of the development of scale damage as the stress accumulates.

Oxidation of Titanium Aluminide
The intermetallic titanium aluminide is an attractive material from the point of view of its strength to weight ratio. However, it is susceptible to rapid oxidation at high temperatures and this limits its usefulness. These two papers are concerned with basic studies of the effects of alloying additions on the scaling behaviour of titanium aluminide.

Thermal Barrier Coatings
As gas turbine operating temperatures are increased to achieve higher efficiencies, metallic components need to be kept at lower temperatures to ensure their survival. Thermal barrier coatings provide a means of achieving these lower temperatures and they have been the subject of a large research effort over the past several years. These papers will concentrate firstly on the adhesion of the thermal barrier coatings to the underlying bond-coat metals, and on the effects the bond-coat behaviour will have on thermal barrier coating life. A second group of papers is concerned with aspects of the application of these coatings, their failure mechanisms and prediction of their lifetimes. *Norm Bornstein of UTRC helped in devising the TBC program.*

Internal Oxidation
The dissolution of oxidants into alloys and subsequent precipitation of corrosion product particles beneath the alloy surface is a complex process involving multi-component diffusion, nucleation and growth phenomena and the development and accommodation of stress within the internally oxidised zones. These papers are concerned with fundamental studies of these aspects.

Interfacial Processes
Both papers are concerned with understanding the nature of solid-solid interface reactions and their effect on corrosion. They discuss systems of modern technological interest and focus on the chemical reactions, phase transformations and stress generation which occur at these interfaces.

High-Temperature Corrosion Resistance of Chromia-Formers
Outside the aerospace industry, most high temperature engineering alloys are chromia-formers. Despite the abundance of practical experience available, there is much which remains mysterious about the behaviour of chromia scales and of the alloys in non-oxidising gases. These papers are concerned with the ability of chromia scales to resist attack by corrodents other than oxygen, and with the sulfidation of chromium and chromium-containing alloys.

Interface Instability in Ternary Systems
This paper brings the fundamental methodologies of physical metallurgy to the study of high temperature corrosion reactions. The thermodynamics and kinetics of phase transformations in multi-component systems are applied to an analysis of the morphological development of complex reacting systems.

POSTER SESSIONS

Over 40 posters will be displayed, Session A on Monday and Tuesday and Session B on Wednesday and Thursday. The session Convenor is Peter Hancock, who will chair a panel of judges to select the outstanding poster.

SPONSORS

The Chairman is grateful for financial support from the Gordon Research Conference Special Fund, ONR, NSF, AFOSR, DoE, NASA, EPRI and UNSW.

SCHEDULE OF EVENTS

Sunday, July 20	
7.30 pm	Technical Session
Monday, July 21	
8.45 am	Technical Session
9.30 am	Spouse and Guest Reception
3.00 - 4.30 pm	Poster Session Begins
4.30 - 6.00 pm	Chairman's Reception, Conference Center
7.30 pm	Technical Session
Tuesday, July 22	
8.45 am	Technical Session
7.30 pm	Technical Session
Wednesday, July 23	
8.45 am	Technical Session
7.30 pm	Technical Session
Thursday, July 24	
8.45 am	Technical Session
7.30 pm	Technical Session
10.30 pm	Close of Conference

Gordon Research Conference on Corrosion, 1997

Chairman: David Young, University of New South Wales

Sunday Evening

Oxidation of Non-metallic Materials

Discussion Leader: Michael Graham, National Research Council of Canada

The Growth and Characterisation of Ultra-Thin (<10 nm) Silicon Dioxide Films on Silicon
Eugene Irene, University of North Carolina

Oxidation of Fiber-Reinforced Ceramic Matrix Composites
Nathan Jacobson, NASA Lewis Research Centre

Monday Morning

Stress in Oxide Scales

Discussion Leader: David Shores, University of Minnesota

Stress Analysis by Optical Fluorescence Spectroscopy of Alumina Scales on NiAl and FeCrAl
Mark Hollatz, Manfred Bobeth and Wolfgang Pompe, Max-Planck-Gesellschaft, Dresden

Fracture and Spallation of Oxide Scales
John Nicholls, Cranfield University

Monday Evening

Oxidation of TiAl

Discussion Leader: Michael Schutze, Dechema

The Effects of Niobium on the Oxidation of TiAl
Rien Stroosnidjer, Ispra

The Role of Chromium in Promoting Protective Alumina Scale Formation by Gamma-Based Ti-Al-Cr Alloys
Michael Brady, Oak Ridge National Laboratory

Tuesday Morning

Thermal Barrier Coatings I

Discussion Leader : William Allen, United Technologies

Adhesion of Thermal Barrier Coatings on Alumina and Alumina-forming Alloys
Klaus Fritscher - German Aerospace Research Establishment

Effects of Bond Coat Behaviour on TBC Life
William Brindley, NASA Lewis Research Centre

Tuesday Evening

Thermal Barrier Coatings II

Discussion Leader: Ian Wright, Oak Ridge National Laboratory

The Application of Thermal Barrier Coatings in Combustion Turbines
V. Sri Srinivasan, Westinghouse Electric Corporation

Thermal Barrier Coatings, Failure Mechanisms and Life Predictions
Lorenz Singheiser, Research Centre Julich

Wednesday Morning

Internal Oxidation

Discussion Leader: Jerry Meier, University of Pittsburgh

Internal Nitridation and Oxidation Studies
George Savva & George Weatherly, McMaster University

The Effects of Growth Stress on Internal Oxidation of Nickel-base Alloys
Howard Stott, UMIST

Wednesday Evening

Interfacial Processes

Discussion Leader: Francesco Gesmundo, Universita di Genova

Solid-state interface reactions and their application to oxide scale growth
Bernard Pieraggi, Ecole Nationale Superieure de Chemie, Toulouse

Protecting Carbon-Carbon Composites with Carbon Fibre Reinforced Diffusion Barriers: Protocols Reactions and Interfaces
Paul Pemsler, Castle Technology Corporation, Meri Treska and Linn W. Hobbs, Massachusetts Institute of Technology

Thursday Morning

High Temperature Corrosion Resistance of Chromia-Formers

Discussion Leader: Brian Gleeson, University of New South Wales

Chromia scales: their ability to resist attack by gaseous corrodents, especially those containing chlorine, and by molten glass.
Pierre Steinmetz, Universite Henri Poincare

Sulfidation Properties of chromium and Chromium-bearing Alloys
Toshio Narita, Hokkaido University

Thursday Evening

Discussion Leader: John Stringer, Electric Power Research Institute

Interface Instability in Ternary Systems with Application to Oxidation, Nitridation and Sulfidation
Jack Kirkaldy, McMaster University

GORDON RESEARCH CONFERENCES
r200 CONFERENCE REGISTRATION LIST

97-S-CS1-7 CORROSION - DRY
COLBY SAWYER 1 JUL-20-97

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