

# **20th Annual Conference on Fossil Energy Materials 2006**

**Knoxville, Tennessee, USA  
12 – 14 June 2006**

**ISBN: 978-1-61567-738-2**

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571  
[www.proceedings.com](http://www.proceedings.com)

**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2008) by the National Energy Technology Laboratory  
All rights reserved.

Printed by Curran Associates, Inc. (2032)

For permission requests, please contact the National Energy Technology Laboratory  
at the address below.

National Energy Technology Laboratory  
626 Cochrans Mill Road  
P.O. Box 10940  
Pittsburgh, PA 15236-0940

Phone: (412) 386-4687  
Fax: (412) 386-4604

[www.netl.doe.gov](http://www.netl.doe.gov)

## CONTENTS

Disclaimer

Preface

### **SESSION 1 – NEW ALLOYS**

#### **1a. High Temperature ‘Conventional’ Wrought Alloys**

Advanced Pressure Boundary Materials

*Mike Santella, Oak Ridge National Laboratory* ..... 2

Fireside Corrosion of Alloys for USC Plants

*Ken Natesan, J.-H. Park Argonne National Laboratory* ..... 9

Multiphase High Temperature Alloys: Exploration of Laves-Strengthened Steels

*Yukinori Yamamoto, Mike Brady, Oak Ridge National Laboratory* ..... 20

#### **1b. Oxide Dispersion-Strengthened Alloys**

Enabling the Practical Application of Oxide Dispersion-Strengthened Ferritic Steels

*Ian Wright, Oak Ridge National Laboratory* ..... 30

Control of Defects and Microstructure in ODS Alloys

*Andy Jones, University of Liverpool* ..... 39

Solid State Joining of Oxide Dispersion Strengthened Alloy Tubes

*Bimal Kad, University of California at San Diego* ..... 47

### **SESSION 2 – POSTERS—BREAKTHROUGH CONCEPTS**

Development of Ultra-High Temperature Molybdenum Borosilicides

*Joachim Schneibel, Oak Ridge National Laboratory, Rob Richie, UC Berkley* ..... 56

Development of Silicide Diffusion Coating on Multiphase Mo-Si-B Alloy by Halide-Activated Pack

Cementation, *Matt Kramer, Ames Laboratory* ..... 66

Effects of Tungsten on the Microstructures of TiAl-Based Intermetallics

*Peter Liaw, University of Tennessee* ..... 74

In-situ Mechanical Property Measurement and Study of Impurity Embrittlement and Metal Oxides

Ductility Enhancement Mechanism in Chromium Alloys Based on Electronic Structure Analysis, *Bruce Kang, West Virginia University* ..... 84

Microstructure and Properties of HVOF-Sprayed Ni-50Cr Coatings

*Terry C. Totemeier, Richard Wright, Idaho National Engineering and Environmental Laboratory* ..... 103

New Processing Developments in Metallic Powders for Fossil Energy Applications

*Iver Anderson, Robert Terpstra, Ames Laboratory* ..... 111

Steam Turbine Materials and Corrosion  
*Gordon Holcomb, Albany Research Center* ..... 119

Fireside Corrosion Probes-How Well Do They Work?  
*Bernie Covino, Albany Research Center* ..... 127

Corrosion and Joining of ODS FeCrAl Alloys for Very High Temperature Heat Exchangers  
*John Hurley, University of North Dakota* ..... 135

### **SESSION 3 – COATINGS AND PROTECTION OF MATERIALS**

#### **3a. Metallic Coatings for Structural Alloys**

Aluminide Coatings for Power Generation Applications  
*Ying Zhang, Tennessee Technology University* ..... 142

High-Temperature Corrosion Resistance of Candidate FeAlCr Coatings in Low NO<sub>x</sub> Environments, *Joe Murphy, Lehigh University* ..... 150

Concepts for Smart, Protective High-Temperature Coatings  
*Peter Tortorelli, Oak Ridge National Laboratory* ..... 160

Extended Alloy Lifetimes Through Improved Coating Performance and Reactive Element Optimization, *Bruce Pint, Oak Ridge National Laboratory* ..... 166

#### **3b. Ceramic/Composite Coatings**

YSZ Thermal Barrier Coatings by MOCVD  
*Ted Besmann, Oak Ridge National Laboratory* ..... 177

Protection Systems: Corrosion-Resistant Coatings  
*Beth Armstrong, Oak Ridge National Laboratory* ..... 184

Development of Nondestructive Evaluation Methods for Ceramic Coatings  
*Bill Ellingson, Argonne National Laboratory* ..... 192

### **SESSION 4 – FUNCTIONAL MATERIALS**

#### **4a. Ceramics & Refractories**

Low-Chrome/Chrome Free Refractories for Slagging Gasifiers  
*James Bennett, Albany Research Center* ..... 198

Pilot Facility for the Production of Silicon Carbide Fibrils  
*Richard Nixdorf, ReMaxCo Technologies, Inc* ..... 205

#### **4b. Activated Carbon Structures**

Activated Carbon Composites for Air Separation  
*Fred Baker, Oak Ridge National Laboratory* ..... 209

#### **4c. Inorganic Membranes & Structures**

Gas Sensors for Fossil Energy Applications <i>Tim Armstrong, Oak Ridge National Laboratory</i> .....	218
Development of Inorganic Membranes for Hydrogen Separation <i>Brian Bischoff, Oak Ridge National Laboratory</i> .....	226
Metal Membranes for Hydrogen Separation <i>Steve Paglieri, Los Alamos National Laboratory</i> .....	234
Advances in Air Brazing: Brazing Sealing Technology for Gas Separation Membranes <i>Scott Weil, Pacific Northwest National Laboratory</i> .....	242
Appendix 1– Final Program.....	253
Appendix 2 – Attendees.....	259
Distribution List .....	n/a