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of the*

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PREFACE

The Fifteenth Annual Conference on Fossil Energy Materials was held in Knoxville, Tennessee, on April 30 through May 2, 2001. The meeting was sponsored by the U.S. Department of Energy's (DOE) Office of Fossil Energy through the Advanced Research Materials Program (ARM). The objective of the ARM Program is to conduct research and development on materials for longer-term fossil energy applications, as well as for generic needs of various fossil fuel technologies. The management of the program has been decentralized to the DOE Oak Ridge Operations Office and Oak Ridge National Laboratory (ORNL). The research is performed by staff members at ORNL and by researchers at other national laboratories, universities, and in private industry. The work is divided into the following categories: (1) structural, ceramics, (2) new alloys and coatings, (3) functional materials, and (4) technology development and transfer.

These proceedings were produced primarily from electronic files provided by the authors. They have been neither refereed nor extensively edited. However, most of the papers have already undergone technical review within the individual organizations before submission to the Program Office. The proceedings are available on the Fossil Energy home page at <http://www.ornl.gov/fossil> (Workshops and Conferences).

The successful completion of the conference and publication of the proceedings has required help from several people. The organizers wish to thank Angela Beach of the ORNL Conference Office for her help in the many arrangements, and the numerous staff and support personnel associated with the conference. Finally, we express our sincere appreciation to the authors whose efforts are the very basis of the conference.

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D. P. Stinton

R. W. Swindeman

P. F. Tortorelli

I. G. Wright

Albany Research Center

R. P. Walters

**PROCEEDINGS OF THE FIFTEENTH ANNUAL CONFERENCE
ON FOSSIL ENERGY MATERIALS**

**April 30–May 2, 2001
Knoxville, Tennessee**

**R. R. Judkins
Fossil Energy Program Director**

Date Published: September 2001

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Oxidation Resistance, Fracture Toughness and Creep Strength of Mo-Si-B Alloys Containing -Mo, J. H. Schneibel and D. S. Easton

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E. C. Thompson

Gas Cleaning

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B. A. Pint, K. L. More, A. J. Thom, and M. Akinc

*Modeling of Chemical Vapor Deposited Zirconia for Thermal Barrier and Environmental Barrier
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Advanced Conventional Alloys

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ODS Alloys

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P. Liaw, C. T. Liu, L. Heatherly, and E. P. George

Computational Hydrogen Embrittlement and Thermal Expansion Simulations of Iron Aluminides,
R. Cisloiu, B. S.-J. Kang, and B. R. Cooper

FINAL PROGRAM
15th ANNUAL CONFERENCE ON FOSSIL ENERGY MATERIALS
Hyatt Regency Hotel
Knoxville, Tennessee
April 30–May 2, 2001

Monday, April 30

Registration 12:00–1:00 P.M.

- 1:00 Welcome and Introductory Remarks,
R. R. Judkins, Oak Ridge National
Laboratory

Session I—Functional Materials

- 1:10 *Introductory Remarks*, T. R. Armstrong,
Oak Ridge National Laboratory
- 1:20 Invited Presentation—Ted McMahon,
National Energy Technology
Laboratory: *The NETL Gas Separations
Program*
- 2:00 *Efficient Production of Pure Hydrogen
from Hydrocarbons Using Palladium
Membrane Reactors*, S. A. Birdsall, Los
Alamos National Laboratory
- 2:25 *A Multiprogram Initiative to Develop
Hydrogen Separation and Purification
Membranes*, D. Loy, Sandia National
Laboratories
- 2:50 *Development of Inorganic Membranes
for Gas Separation*, D. E. Fain, East
Tennessee Technology Park
- 3:15 Break
- 3:45 *Bismuth Oxide Solid Electrolyte Oxygen
Separation Membranes*, S. D. Nunn,
Oak Ridge National Laboratory

- 4:10 *Solid Oxide Electrolyte Systems*,
L. Pederson, Pacific Northwest National
Laboratory

- 4:35 *Development of Novel Activated Carbon
Composites*, T. D. Burchell, Oak Ridge
National Laboratory

- 5:00 Adjourn

- 5:30 Invited Presentation—*Update on the
Vision 21 Program*, L. Ruth, National
Energy Technology Laboratory

- 5:55 Reception and Poster Session

Tuesday, May 1

7:00 Continental Breakfast

**Session II—Coatings and Protection
of Materials**

- 8:00 Introductory Remarks
- 8:10 Invited Presentation, S. Osgerby, NPL,
*Towards Lifetime Prediction Models for
Gas Turbine Coatings—Past, Present
and Future Work at NPL*
- 8:40 *Investigation of Iron Aluminide Weld
Overlays*, J. N. DuPont, Lehigh
University
- 9:05 *Coating Microstructure-Property Issues*,
R. N. Wright, Idaho National
Engineering and Environmental
Laboratory



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9:30	<i>CVD Metallic Coatings/Extended Lifetime Coatings</i> , B. A. Pint, Oak Ridge National Laboratory	2:55	<i>Reduction in Defect Content in ODS Alloys</i> , A. R. Jones, University of Liverpool
9:55	Break	3:20	Break
10:25	<i>Slurry-Based Mullite Coatings for Corrosion Resistance</i> , B. L. Armstrong, Oak Ridge National Laboratory	3:45	<i>Optimization of ODS Alloy Properties</i> , B. Kad, University of California at San Diego
10:45	<i>Development of Nondestructive Evaluation Methods for Ceramic Coatings</i> , W. A. Ellingson, Argonne National Laboratory	4:10	<i>Corrosion and Mechanical Properties of Materials in Combustion and Mixed-Gas Environments</i> , K. Natesan, Argonne National Laboratory
11:05	<i>Chemically Vapor Deposited YSZ for Thermal and Environmental Barrier Coatings</i> , T. M. Besmann, J. C. McLaughlin Oak Ridge National Laboratory and V. Varanasi, University of Florida	4:35	<i>High Creep-Strength Alloys</i> , P. J. Maziasz, Oak Ridge National Laboratory (CRADA with INCO)
11:25	<i>High-Temperature Materials Testing in a Pilot-Scale Coal Combustion System</i> , J. Hurley and C. R. Crocker, University of North Dakota, Energy and Environmental Research Center	5:00	Adjourn
11:45	Lunch		

Session III—New Alloys

1:30	Introductory Remarks, I. G. Wright, Oak Ridge National Laboratory
1:35	Invited Presentation, <i>Overview of Materials Needs for Advanced Steam Generators</i> , R. Viswanathan, EPRI
2:05	<i>Progress on Developing Codes and Standards Requirements for New Alloys</i> , R. W. Swindeman, Oak Ridge National Laboratory
2:30	<i>ODS Alloy Development</i> , I. G. Wright, Oak Ridge National Laboratory

Wednesday, May 2

7:00 Continental Breakfast

Session IV—Albany Research Center—Advanced Metallurgical Processes Program

8:00	Introductory Remarks
8:10	<i>Overview: Fossil Energy Advanced Metallurgical Processes Program</i> , R. P. Walters, Albany Research Center
8:20	<i>Oxidation/Sulfidation Resistant Materials</i> , J. S. Dunning, Albany Research Center
8:45	<i>Oxidation in a Temperature Gradient</i> , G. R. Holcomb, Albany Research Center
9:10	<i>Erosive Wear of Selected Materials for Fossil Energy Applications</i> , J. C. Rawers, Albany Research Center

- 9:35 Break
- 10:05 *Advanced Titanium Processing*, A. D. Hartman, Albany Research Center
- 10:30 *Microchannel Devices*, D. E. Alman, Albany Research Center
- 10:55 *Refractory Failure in IGCC Fossil Fuel Power Systems*, C. P. Dogan, Albany Research Center
- 11:20 Lunch
- Session V—Ultrahigh Performance Materials**
- 1:00 *Introductory Remarks*, D. P. Stinton, Oak Ridge National Laboratory
- 1:15 *Multi-Phase Cr-Based Alloys for Aggressive High Temperature Environments*, M. P. Brady, Oak Ridge National Laboratory
- 1:40 *Mo-Si Alloy Development*, J. H. Schneibel, Oak Ridge National Laboratory
- 2:05 *Mo-Si Alloy Development*, M. J. Kramer, Ames Laboratory
- 2:30 Break
- 3:00 *Development of a Commercial Process for the Production of Silicon Carbide Fibrils*, R. D. Nixdorf, ReMaxCo Technologies, Inc
- 3:25 Closing remarks and adjourn

Posters

Fuel Cells

Fabrication Technology for Fuel Cell Containment and Liners, M. L. Santella, Oak Ridge National Laboratory

Improved Fuel Cell Materials and Economical Fabrication, T. R. Armstrong, Oak Ridge National Laboratory

Performance Evaluation of Thin-Film Multi-Layer Packages, K. Reifsnider, Virginia Polytechnic Institute

Low Cost Processing Technique For Solid Oxide Fuel Cells, U. B. Pal and V. K. Sarin, Boston University

Gas Cleaning/Separation

Processing Analysis and Characterization of Membranes for Hydrogen Separation, T. R. Armstrong, Oak Ridge National Laboratory

Bismuth Oxide Solid Electrolyte Systems, L. Pederson, Pacific Northwest National Laboratory

Gas Cleaning

Metallic Filters for Hot Gas Cleaning, I. E. Anderson, Ames Laboratory

Coatings and Protection of Materials

High Temperature Materials Testing in Coal Combustion Environments, M. Mathur and M. Freeman, National Energy Technology Laboratory

Reliable Ceramic Coatings for High-Temperature Environmental Resistance in Fossil Environments, P. F. Tortorelli, Oak Ridge National Laboratory

Modeling of Chemically Vapor Deposited Zirconia for Thermal Barrier and Environmental Barrier Coatings, T. Starr, University of Louisville

Advanced Conventional Alloys

Improved Recuperator Alloys, P. J. Maziasz, Oak Ridge National Laboratory (CRADA with Solar Turbines)

ODS Alloys

In-Plant Corrosion Probe Tests, J. L. Blough,
Foster Wheeler Development Corporation

Development of MA956 Tubes (joint with
Special Metals), I. G. Wright, Oak Ridge
National Laboratory

Ultrahigh Performance Materials Poster**Presentations**

Study of Fatigue and Fracture Behavior of Cr-Based Alloys and Intermetallic Materials, P. Liaw, University of Tennessee

Evaluation of the Intrinsic and Extrinsic Fracture Behavior of Iron Aluminides,
B. R. Cooper, West Virginia University

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