

Proceedings: Twelfth Annual EPRI Contractors'  
Conference on Fuel Science and Conversion

---

AP-5460-SR

Proceedings, February 1988

Palo Alto, California  
May 13-14, 1987

Conference Organizer  
H. E. Lebowitz  
ELECTRIC POWER RESEARCH INSTITUTE

662.6

E64

1987

Sponsored by

Electric Power Research Institute  
3412 Hillview Avenue  
Palo Alto, California 94304

EPRI Project Manager  
H. E. Lebowitz

Fuel Science and Conversion Program  
Advanced Power Systems Division

---

# R E P O R T S U M M A R Y

---

SUBJECTS Coal cleaning and upgrading / Coal-derived fuels

---

TOPICS Coal liquefaction Coal  
Fuel oils Coal cleaning  
Synthetic fuels

---

AUDIENCE Fuels engineers / R&D scientists

---

## **Proceedings: Twelfth Annual EPRI Contractors' Conference on Fuel Science and Conversion**

Conference participants met for an update on clean liquid and solid-fuel research. Discussion focused on the state of the art of coal liquefaction, coal-oil coprocessing, methanol synthesis, coal science, and advanced coal cleaning. Research on advanced, two-stage liquefaction, as well as on cleaning coal using oil agglomeration and biologic solubilization of coals, produced particularly promising results.

---

BACKGROUND This annual conference, part of the EPRI research effort related to fuel science and conversion, continues work begun in 11 previous conferences (the EPRI contractors' conferences on clean liquid and solid fuels). EPRI report AP-4253-SR describes the tenth such conference and AP-5043-SR, the eleventh.

---

OBJECTIVE To provide a forum for information exchange among researchers, EPRI staff, and representatives of utilities and government agencies on coal science and coal upgrading.

---

APPROACH More than 100 conference participants from the United States and Canada met in Palo Alto, May 13-14, 1987, to hear 19 presentations on the following topics:

- Advanced two-stage coal liquefaction and coprocessing of coal and heavy oils
  - Methanol synthesis from CO-rich gas for use in gasifier-combined-cycle power plants
  - Coal upgrading, including upgrading of low-rank coals and sulfur reduction from bituminous coals
  - Coal science, including coal chemistry and biologic conversion of coal
- 

KEY POINTS • Work on advanced, two-stage liquefaction at the Wilsonville, Alabama, Advanced Coal Liquefaction R&D Facility demonstrates conclusively that two-stage liquefaction yields increased liquid product and improved

---

product quality. Both close-coupled reactors and coprocessing of coal and heavy oils result in unexpected increases in plant throughput.

- The development of oil agglomeration technology has advanced significantly. Removal of pyritic sulfur from many coals appears possible.
- The technology for biologic solubilization of coal continues to mature. Rapid conversion of lignite to water-soluble products has been achieved with enzymes produced from white rot fungi.

---

PROJECT EPRI Project Manager: Howard E. Lebowitz  
Advanced Power Systems Division

---

For further information on EPRI research programs, call  
EPRI Technical Information Specialists (415) 855-2411.

#### ORDERING INFORMATION

Requests for copies of this report should be directed to Research Reports Center (RRC), Box 50490, Palo Alto, CA 94303, (415) 965-4081. There is no charge for reports requested by EPRI member utilities and affiliates, U.S. utility associations, U.S. government agencies (federal, state, and local), media, and foreign organizations with which EPRI has an information exchange agreement. On request, RRC will send a catalog of EPRI reports.

Electric Power Research Institute and EPRI are registered service marks of Electric Power Research Institute, Inc.

Copyright © 1988 Electric Power Research Institute, Inc. All rights reserved.

#### NOTICE

This report was prepared by the Electric Power Research Institute, Inc. (EPRI). Neither EPRI, members of EPRI, nor any person acting on their behalf: (a) makes any warranty, express or implied, with respect to the use of any information, apparatus, method, or process disclosed in this report or that such use may not infringe privately owned rights; or (b) assumes any liabilities with respect to the use of, or for damages resulting from the use of, any information, apparatus, method, or process disclosed in this report.

## ABSTRACT

EPRI's Twelfth Annual Contractors' Conference on Fuel Science and Conversion was held on May 13 and 14 1987 in Palo Alto California. The conference featured results of work on coal science coal liquefaction methanol production coal oil coprocessing and coal upgrading.

## PREFACE

The Fuel Science and Conversion Contractors' Conference was held on May 13 and 14 1987 in Palo Alto California. Presentations were given in the following areas:

- Two-stage liquefaction of coal
- Synthesis of methanol from CO-rich gas for use in gasifier combined-cycle power plants
- Coal science including the structure of bituminous subbituminous coal and lignite and biological processing of coal
- Coal upgrading including deashing and dewatering of low-rank coal by oil agglomeration and removal of pyrite sulfur from bituminous coal
- Coprocessing of coal and heavy oils
- Storage compatibility of fuel oils

## CONTENTS

<u>Section</u>		<u>Page</u>
PART 1: COAL STRUCTURE AND UPGRADING		
1	Chemical Structural Comparison of Lignite, Subbituminous, and Bituminous Coals K. E. Chung and I. B. Goldberg Rockwell International Science Center	1-1
2	Structural Studies on a Wyodak Subbituminous Coal The Potassium - Crown Ether Reaction R. Narayan and S. L. Huang Purdue University	2-1
3	Progress in Biological Conversion of Low Rank Coals B. W. Wilson, J. W. Pyne, R. M. Bean, D. L. Stewart, R. B. Lucke, B. L. Thomas, M. T. Thomas and J. A. Campbell Battelle Pacific Northwest Laboratories and M. S. Cohen, University of Hartford	3-1
4	Progress Report on the Selective Oxidation of Pyrites in Coals T. L. Tewksbury, H. E. Carlton and J. H. Oxley Battelle Columbus Laboratories	4-1
5	Coal Upgrading By Selective Agglomeration W. Pawlak, A. Turlak, Y. Briker and B. Ignasiak Alberta Research Council	5-1
PART 2: METHANOL AND INDIRECT LIQUEFACTION		
6	Potential Improvements in Methanol Synthesis S. Lee, V. R. Parameswaran, A. V. Sawant and M. K. Ko University of Akron	6-1
7	Update of Low Temperature Catalyst Development D. Mahajan, R. S. Sapienza, T. E. O'Hare and G. Skaperdas Brookhaven National Laboratory	7-1
8	Once-Through Methanol (OTM) Technology, Economics, and Demonstration D. T. Bradshaw, R. W. Weatherington and T. L. Wright Tennessee Valley Authority	8-1
9	Stability and Selectivity of Potassium Promoted Iron Catalyst in Slurry Fischer-Tropsch Synthesis M. F. Zarochak, M. A. McDonald and V. U. S. Rao U.S. Department of Energy - Pittsburgh Energy Technology Center	9-1

<u>Section</u>	<u>Page</u>
PART 3: COAL LIQUEFACTION	
10	10-1
Recent Liquefaction Development at Wilsonville Plant With Close-Coupled Reactors R. V. Nalitham, J. M. Lee and C. W. Lamb UE & C - Catalytic, Inc.	
11	11-1
Coal Liquefaction Catalyst Deactivation A. M. Tait, M. A. Pacheco and D. J. Sajkowski Amoco Oil Company	
12	12-1
Wilsonville-Kinetic Models and ITSL Simulation A. Prasad, R. V. Nalitham and T. E. Pinkston UE & C - Catalytic, Inc.	
13	13-1
Assessment of Rapid Methods for Predicting Stability and Compatibility of Residual Fuel Oils R. P. Anderson, J. W. Goetzinger and J. W. Reynolds National Institute for Petroleum and Energy Research (NIPER)	
14	14-1
Assessing the Economic Impact of Two-Stage Liquefaction Process Improvements D. Gray and G. Tomilson Mitre Corporation	
PART 4: COAL OIL CO-PROCESSING	
15	15-1
Coal/Oil Co-Processing Program Update J. E. Duddy, J. B. McLean and T. O. Smith Hydrocarbon Research, Inc.	
16	16-1
Update: Lummus Co-Processing Project and Results of Catalyst Activity Maintenance Testing M. Greene, A. Gupta and W. Moon Lummus Crest, Inc.	
17	17-1
Effect of Coal Concentration on Product Distribution in CANMET Co-Processing P. M. Rahimi, S. A. Fouda and J. F. Kelly Canada Centre for Mineral and Energy Technology (CANMET)	
18	18-1
Continuous Bench-Scale Testing of Co-Processing C. P. Luebke and M. J. Humbach, UOP, Inc. and J. G. Gatsis, B. J. Nelson and C. L. Lea Allied-Signal Engineered - Materials Research Center	
APPENDIX A: AUTHORS	A-1