



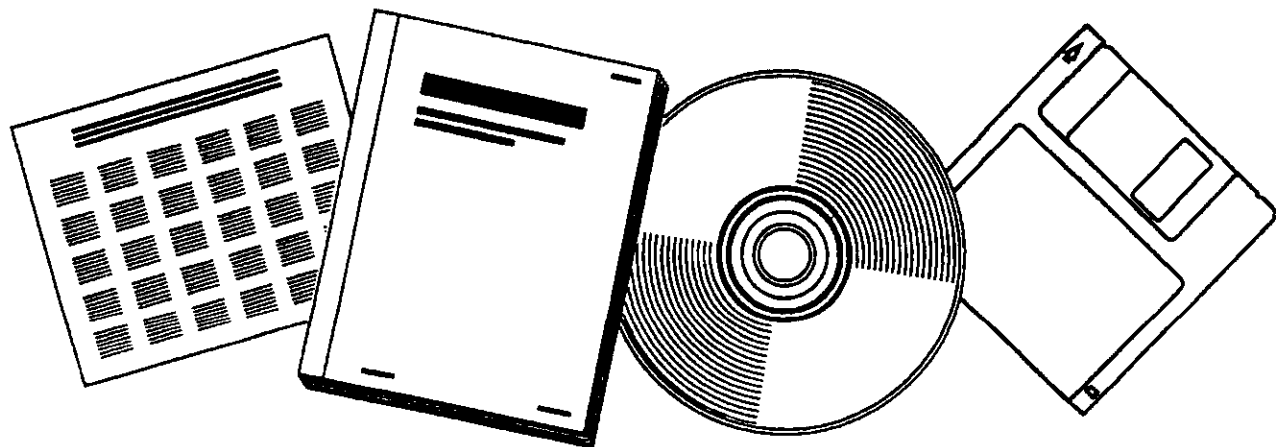
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COAL LIQUEFACTION AND GAS CONVERSION: PROCEEDINGS. VOLUME 2

DEPARTMENT OF ENERGY, PITTSBURGH, PA.
PITTSBURGH ENERGY TECHNOLOGY CENTER

1993



U.S. DEPARTMENT OF COMMERCE
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U.S. Department of Energy
Pittsburgh Energy Technology Center

COAL LIQUEFACTION AND GAS CONVERSION

CONTRACTORS REVIEW CONFERENCE

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PROCEEDINGS

VOLUME II

SEPTEMBER 27 - 29, 1993

Hyatt Regency Hotel
Pittsburgh, Pennsylvania

MASTER

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P. Zhou, Burns and Roe Services Corporation

SESSION CHAIRPERSONS

US Department of Energy/Pittsburgh Energy Technology Center

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A.C. Bose

E.B. Klunder

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M.A. Nowak

V.U.S. Rao

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Burns and Roe Services Corporation

J.J. Marano

R.D. Srivastava

P. Zhou

CONFERENCE STAFF

Center for Conference Management

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INVITED PLENARY SPEAKERS

M.M.G. Senden, Manager

Hydrocarbon Synthesis and Gasification

Shell Laboratories Amsterdam, The Netherlands

R.F. Bauman, Director

Synthetic Fuels Research

Exxon Research & Development Laboratories, USA

S.R. Drozda, Business Development Officer

U.S. Small Business Administration

Pittsburgh District Office

INVITED SESSION SPEAKERS

D.J. Allardice, Coal Corporation of Victoria, Australia
J. Erwin, Southwest Research Institute, USA
M.D. Gray, British Coal Liquefaction Project, UK
R.D. Hughes, British Coal Liquefaction Project, UK
K. Ikeda, Nippon Steel Corporation, Japan
S. Katsushima, New Energy & Industrial Technology Development Organization, Japan
T.J. Mazanec, BP America, USA
M.D. Reed, British Coal Liquefaction Project, UK
N. Robinson, British Coal Liquefaction Project, UK

INVITED PRESENTATION REVIEWERS

N.L. Carr, Consultant
D. Gray, MITRE
A.M. Hartstein, US Department of Energy/HQ
H.W. Haynes, Jr., University of Wyoming
R.F. Hickey, US Department of Energy/Pittsburgh Energy Technology Center
G.P. Holder, University of Pittsburgh
A.L. Lee, Institute of Gas Technology
T.J. Mazanec, BP America
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J. Shen, US Department of Energy/HQ
H.P. Stephens, Sandia National Laboratories
I. Wender, University of Pittsburgh

U.S. Department of Energy
Pittsburgh Energy Technology Center

COAL LIQUEFACTION AND GAS CONVERSION

CONTRACTORS' REVIEW CONFERENCE

September 27 - 29, 1993

**Hyatt Regency Hotel
Pittsburgh, Pennsylvania**

AGENDA



MONDAY, SEPTEMBER 27, 1993

AR - COAL LIQUEFACTION

(Ballroom 1 & 2)

Session Chairperson: V.U.S. Rao, Pittsburgh Energy Technology Center

8:30 - 8:40 a.m. Introductory Remarks

**8:40 - 9:10 a.m. Steam Pretreatment for Coal Liquefaction
R.A. Graff, The City College of New York**

**9:10 - 9:40 a.m. The Dual Role of Oxygen Functions in Coal
Pretreatment and Liquefaction: Crosslinking
and Cleavage Reactions
M.A. Serio, Advanced Fuel Research, Inc.**

**9:40 - 10:10 a.m. Technical and Economic Evaluation of a New Process
for Co-Liquefying Coal and Scrap Tires
M. El-Halwagi, Auburn University**

10:10 - 10:30 a.m. BREAK

**10:30 - 11:00 a.m. Chemistry of Catalytic Coal Liquefaction
B.C. Bockrath, Pittsburgh Energy Technology Center**

**11:00 - 11:30 a.m. High Temperature/High Pressure ESR Spectroscopy
of Free Radicals in Coal Liquefaction, Coprocessing
and Catalyst Testing
M.M. Ibrahim, West Virginia University**

11:30 a.m. - 1:00 p.m. LUNCH

afternoon session continued on next page

MONDAY, SEPTEMBER 27, 1993 (continued)

**AR-COAL LIQUEFACTION
(Ballroom 1 & 2)**

Session Chairperson: M. J. Baird, Pittsburgh Energy Technology Center

- 1:00 - 1:30 p.m. Dispersed Catalysts and Carbon-Based Catalysts for Direct Coal Liquefaction
M. Farcasiu, Pittsburgh Energy Technology Center**
- 1:30 - 2:00 p.m. New Approaches in the Synthesis and Characterization of Iron-Based Catalysts for Direct Coal Liquefaction
G.P. Huffman, University of Kentucky, CFFLS**
- 2:00 - 2:30 p.m. Clay-Supported Catalysts for Coal Liquefaction
E.S. Olson, Universal Fuel Development Associates, Inc.**
- 2:30 - 2:50 p.m. BREAK**
- 2:50 - 3:20 p.m. Activity Testing of Fine-Particle Size, Iron Catalysts for Coal Liquefaction
F.V. Stohl, Sandia National Laboratories**
- 3:20 - 4:30 p.m. Open Discussion - Catalyst Testing
Discussion Leader: M. J. Baird**

ADJOURN

MONDAY, SEPTEMBER 27, 1993

**GAS-TO-LIQUIDS
(Regency A)**

Session Chairperson: A.C. Bose, Pittsburgh Energy Technology Center

8:30 - 8:40 a.m. Introductory Remarks

8:40 - 9:10 a.m. Development of Ceramic Membranes for Partial
Oxygenation of Hydrocarbon Fuels to High-Value-
Added Products
U. Balachandran, Argonne National Laboratory

9:10 - 9:40 a.m. Oxidative Coupling of Methane using
Membrane Reactors
Y.H. Ma, Worcester Polytechnic Institute

9:40 - 10:10 a.m. Electropox: BP's Novel Oxidation Technology
T.J. Mazanec, BP Chemicals

10:10 - 10:30 a.m. BREAK

10:30 - 11:00 a.m. Methyl Chloride via Oxyhydrochlorination of
Methane
B. Naasz, Dow Corning Corporation

11:00 - 11:30 a.m. Exploratory Studies of Oxidative Conversion of
Methane to Methanol
C.E. Taylor, Pittsburgh Energy Technology Center

11:30 a.m. - 1:00 p.m. LUNCH

afternoon session continued on next page

MONDAY, SEPTEMBER 27, 1993 (continued)

**GAS-TO-LIQUIDS
(Regency A)**

Session Chairperson: R. D. Srivastava, Burns and Roe Services Corp.

- 1:00 - 1:30 p.m. Conversion of Light Hydrocarbon Gases to Metal Carbides for Production of Liquid Fuels and Chemicals
W.A. Peters, Massachusetts Institute of Technology
- 1:30 - 2:00 p.m. Light Hydrocarbon Gas Conversion using Halogenated Iron Dodecaphenylporphyrin Catalysts
J. A. Shelnett, Sandia National Laboratories
- 2:00 - 2:30 p.m. Novel Catalysts for Methane Activation
R. Malhotra, SRI International
- 2:30 - 2:50 p.m. BREAK
- 2:50 - 3:20 p.m. Development of Vanadium-Phosphate Catalysts for Methane Partial Oxidation
R.L. McCormick, Ammax Research & Development Center
- 3:20 - 3:50 p.m. Direct Aromatization of Methane
G. Marcelin, Altamira Instruments, Inc.

MEETING
ADJOURN

TUESDAY, SEPTEMBER 28, 1993

**PLENARY SESSION
(Ballroom 4)**

- 8:30 - 8:45 a.m. Welcome and Introductory Remarks
S. Rogers
Pittsburgh Energy Technology Center
- 8:45 - 9:15 a.m. DOE Keynote Address
G. V. McGurl
Pittsburgh Energy Technology Center
- 9:15 - 9:55 a.m. Plenary Speaker
M.M.G. Senden, Koninklijke/Shell Laboratorium
Amsterdam, The Netherlands
- 9:55 - 10:15 a.m. BREAK
- 10:15 - 10:55 a.m. Plenary Speaker
R.F. Bauman, EXXON Research &
Development Laboratories
- 10:55 - 11:10 a.m. S.R. Drozda
U.S. Small Business Administration
District Office/Pittsburgh

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TUESDAY, SEPTEMBER 28, 1993

**DIRECT LIQUEFACTION
(Regency B)**

Session Co-Chairpersons:

S. C. Kornfeld and M. A. Nowak, Pittsburgh Energy Technology Center

**11:15 - 11:45 a.m. Proof of Concept Facility for Direct Liquefaction
A.G. Comolli, Hydrocarbon Research Inc.**

**11:45 a.m. - 12:15 p.m. Direct Coal Liquefaction - Capital Cost and
Economics for Improved Baseline Design
S.K. Poddar, Bechtel Corporation**

12:15 - 1:45 p.m. LUNCH

**1:45 - 2:15 p.m. Improved Coal Liquefaction through
Enhanced Recycle Distillate Quality
F. J. Derbyshire, Center for Applied Energy Research,
University of Kentucky**

**2:15 - 2:45 p.m. Advanced Liquefaction Using Coal Swelling and
Catalyst Dispersion
D.C. Croaauer, Amoco Oil Company**

**2:45 - 3:15 p.m. Application of Carbon Monoxide/Steam and
Counterflow Reactor Technologies to Coal
Liquefaction
P.L. Simpson, Alberta Research Council
D. J. Berger, Canadian Energy Developments Inc.**

3:15 - 3:30 p.m. BREAK

**3:30 - 4:00 p.m. Highly Dispersed Catalysts for Coal Liquefaction
A. S. Hirschon, SRI International**

**4:00 - 4:30 p.m. Advanced Concepts in Coal Liquefaction -
Optimization of Reactor Configuration in
Coal Liquefaction
V. R. Pradhan, Hydrocarbon Research Inc.**

**4:30 - 5:00 p.m. Coal Liquefaction Process Streams Characterization
and Evaluation
S.D. Brandes, CONSOL, Inc.**

ADJOURN

TUESDAY, SEPTEMBER 28, 1993

**INDIRECT LIQUEFACTION (Oxygenated Fuels)
(Ballroom 2)**

Session Co-Chairpersons:

**G.J. Stiegel, Pittsburgh Energy Technology Center
R.D. Srivastava, Burns and Roe Services Corp.**

- 11:15 - 11:45 a.m.** Heterogeneous Catalytic Process for Alcohol Fuels from Syngas
D.M. Minahan, Union Carbide Chemicals & Plastics Co., Inc.
- 11:45 a.m. - 12:15 p.m.** The Economical Production of Alcohol Fuels from Coal-Derived Synthesis Gas
W.B. Whiting, West Virginia University
- 12:15 - 1:45 p.m.** LUNCH
- 1:45 - 2:15 p.m.** Isobutanol Dehydration: A Key Step in Producing MTBE from Syngas
B.A. Toseland, Air Products and Chemicals, Inc.
- 2:15 - 2:45 p.m.** High Octane Ethers from Synthesis Gas-Derived Alcohols
K. Klier, Lehigh University
- 2:45 - 3:15 p.m.** Progress on Developing Technology for Producing Higher Alcohols from Syngas
G. W. Roberts, North Carolina State University
- 3:15 - 3:30 p.m.** BREAK
- 3:30 - 4:00 p.m.** Development of Alternative Fuels from Synthesis Gas
D.M. Brown, Air Products and Chemicals, Inc.
- 4:00 - 4:30 p.m.** Catalysts and Process Development for Synthesis Gas Conversion to Isobutylene
R. G. Anthony, Texas A&M University

ADJOURN

WEDNESDAY, SEPTEMBER 29, 1993

DIRECT LIQUEFACTION

(Regency B)

Session Co-Chairpersons:

E. B. Klunder and M. J. Baird, Pittsburgh Energy Technology Center

**8:30 - 9:00 a.m. The Effect of Dispersed Catalysts on First Stage
Coal Liquefaction
A. V. Cugini, Pittsburgh Energy Technology Center**

**9:00 - 9:30 a.m. Conceptual Design & Economic Evaluation of BCL
Project
S. Katsushima, New Energy and Industrial
Technology Development Organization, Japan**

**9:00 - 10:00 a.m. Liquefaction Studies on Victorian Brown Coal
D. J. Allardice, Coal Corporation of Victoria,
Australia**

10:00 - 10:20 a.m. BREAK

**10:20 - 11:20 a.m. M. D. Gray, M. D. Reed, R. D. Hughes, N. Robinson
British Coal Corporation, UK**

**10:50 - 11:20 a.m. Liquefaction Characteristics of Wyoming Coal
K. Ikeda, Nippon Steel Corporation, Japan**

11:50 a.m. - 1:20 p.m. LUNCH

afternoon session continued on next page

WEDNESDAY, SEPTEMBER 29, 1993 (continued)

**DIRECT LIQUEFACTION
(Regency B)**

**Session Chairperson:
P. Zhou, Burns and Roe Services Corp.**

- 1:20 - 1:50 p.m. Catalytic Multi-Stage Liquefaction of Coal
L.K.T. Lee, Hydrocarbon Research, Inc.**
- 1:50 - 2:20 p.m. Effects of Low-Temperature Catalytic
Pretreatments on Coal Structure and Reactivity
in Liquefaction
C. Song, The Pennsylvania State University**
- 2:20 - 2:50 p.m. The Effects of Different Drying Processes on Coal
Liquefaction Yields
F.P. Miknis, Western Research Institute**
- 2:50 - 3:10 p.m. BREAK**
- 3:10 - 3:40 p.m. Mitigating Crosslinking Reactions through
Preconversion Strategies
D.F. McMillen, SRI International**
- 3:40 - 4:10 p.m. Surfactant-Assisted Coal Liquefaction at Milder
Processing Conditions
P.K. Sharma and G.S. Hickey
California Institute of Technology**
- 4:10 - 4:40 p.m. New Direction to Preconversion Processing of Coal
M. Nishioka, Viking Systems International**

ADJOURN

WEDNESDAY, SEPTEMBER 29, 1993

**INDIRECT LIQUEFACTION
(FISCHER-TROPSCH TECHNOLOGY)
(Ballroom 2)**

Session Chairperson:

V.U.S. Rao, Pittsburgh Energy Technology Center

- 8:30 - 9:30 a.m. Technology Development for Cobalt Fischer-Tropsch Catalysts
A. H. Singleton, Energy International Corporation**
- 9:00 - 9:30 a.m. Fischer-Tropsch Co/Ru Catalyst Development
R. R. Frame, UOP**
- 9:30 - 10:00 a.m. Technology Development for Iron Fischer-Tropsch Catalysts
B. H. Davis, Center for Applied Energy Research, University of Kentucky, CAER**
- 10:00 - 10:20 a.m. BREAK**
- 10:20 - 10:50 a.m. Fischer-Tropsch Iron Catalyst Development
R.R. Frame, UOP**
- 10:50 - 11:20 a.m. Development of Improved Iron Fischer-Tropsch Catalysts
D. B. Bukur, Texas A&M University**
- 11:20 - 11:50 a.m. Mossbauer Spectroscopy Study of Iron-Based Catalysts Used in Fischer-Tropsch Synthesis
K.R.P.M. Rao, University of Kentucky, CFFLS**
- 11:50 a.m. - 1:20 p.m. LUNCH**

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WEDNESDAY, SEPTEMBER 29, 1993 (continued)

**INDIRECT LIQUEFACTION
(FISCHER-TROPSCH TECHNOLOGY)
(Ballroom 2)**

Session Chairperson:

J.J. Marano, Burns and Roe Services Corp.

- 1:20 - 1:50 p.m. The Selective Catalytic Cracking of Fischer-Tropsch Liquids to High Value Transportation Fuels
W.J. Reagan, Amoco Oil Company**
- 1:50 - 2:20 p.m. The Standing of Fischer-Tropsch Diesel in an Assay of Fuel Performance and Emissions
J. Erwin, Southwest Research Institute**
- 2:20 - 2:50 p.m. Baseline Design/Economics for Advanced Fischer-Tropsch Technology
S. S. Tam, Bechtel Corporation**
- 2:50 - 3:10 p.m. BREAK**
- 3:10 - 3:40 p.m. Opportunities for Reducing Product Costs in Indirect Liquefaction
D. Gray, The MITRE Corporation**
- 3:40 - 4:10 p.m. Fischer-Tropsch Slurry Reactor Modeling
Y. Soong, Pittsburgh Energy Technology Center**

ADJOURN

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