



Thirty-Sixth Annual **INTERNATIONAL PITTSBURGH COAL CONFERENCE**

University of Pittsburgh · Swanson School of Engineering

FINAL PROGRAM

Clean Coal-based Energy/Fuels and the Environment



September 3 - 6, 2019

**Westin Convention Center Hotel
Pittsburgh, PA, USA**



Hosted by:



University of
Pittsburgh

WELCOME!

On behalf of the Conference Advisory Board, Conference Committees, and the University of Pittsburgh we welcome you to the Thirty-Sixth Annual International Pittsburgh Coal Conference, which will be held September 3-6, 2019 at the Westin Convention Center Hotel, Pittsburgh, PA, USA. The Conference is hosted by the University of Pittsburgh, USA.

The theme of this year's conference "Clean Coal-based Energy/Fuels and the Environment" covers wide spectrum of important topics on energy and environmental issues and technologies, which are directly related to extraction and utilization of coal and its byproducts. Over 215 technical papers and posters will be presented at the conference. The Poster Sessions will be held on Thursday, September 5, 2019 from 17:15 to 20:30. For detailed information about the technical sessions, please turn to page 6 in the Technical Program.

This year's invited Plenary Speakers include: The honorable Mr. Steven Winberg, United States Department of Energy, USA; Dr. Steven Carpenter, Enhanced Oil Recovery Institute, USA; Mr. Stephen Nelson, Longview Power, LLC, USA; Prof. Yuemin ZHAO, China University of Mining and Technology, CHINA; Dr. JC (Johan) van Dyk, African Carbon Energy, SOUTH AFRICA; Dr. Alberto Pettinau, Sotacarbo S.p.A., Grande Miniera di Serbariu, ITALY; Dr. Brian Anderson, United States Department of Energy, National Energy Technology Laboratory, USA; Prof. Robert Finkelman, University of Texas, USA; and Prof. Tarunjit S. Butalia, The Ohio State University, USA.

One of the highlights of this year's conference is the first University-Industry Fossil Energy Forum. The Panelist include: Prof. Rodney Andrews, University of Kentucky, USA; Ms. Shannon Angielski, Carbon Utilization Research Council, USA; Mr. Daniel Connell, CONSOL Energy, Inc. USA; Prof. Ben Ebenhack, Marietta College, USA; Dr. Michael Karmis, Virginia Tech, USA; Dr. Andrew Maxson, EPRI, USA; Mr. David Spigelmyer, Marcellus Shale Coalition, USA; and Prof. Jason Trembly, Ohio University, USA. The Forum is moderated by Prof. Richard A. Bajura, West Virginia University, USA.

We express our sincere gratitude to the Plenary Speakers, Forum Panelists and Moderators for their support and involvement, to all the authors and co-authors of the technical papers and to all the members of the Technical Program Committee. Special thanks go to the topic coordinators, co-chairs and speakers for their invaluable contributions to the 2019 technical program.

As the chair of the Advisory Board of the Conference, I deeply appreciate your participation and interest in this year's Conference and we invite you to join us next year for the Thirty-seventh Annual International Pittsburgh Coal Conference, which will be held at the Westin Convention Center Hotel in Pittsburgh, PA, USA, September 7-10, 2020.

Sincerely,

Massood Ramezan, Chair



Senior Technical Advisor at Key Logic Systems, USA

CONFERENCE

REGISTRATION

On-Site Registration will begin Tuesday, September 3 from 12:00 - 20:00 and will continue Wednesday, from 08:00 - 20:00, and Thursday from 08:00 until 16:30.

**Please check in even if you have
Pre-Registered!**

THE INTERNATIONAL PITTSBURGH COAL CONFERENCE

EXECUTIVE DIRECTOR:

Dr. Badie I. Morsi

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GENERAL INFORMATION

CONFERENCE OVERVIEW

TUESDAY, SEPTEMBER 3, 2019

REGISTRATION	08:00 - 20:00
TECHNICAL TOUR	08:00 - 14:30
RECEPTION	18:30 - 20:30

WEDNESDAY, SEPTEMBER 4, 2019

REGISTRATION	08:00 - 20:00
PLENARY SESSION - 1	08:45 - 10:15
TEA BREAK	10:15 - 10:30
UNI-IND FOSSIL ENERGY FORUM	10:30 - 12:30
CONFERENCE LUNCH	12:30 - 13:30
CONCURRENT TECH. SESSIONS	13:30 - 15:10
TEA BREAK	15:10 - 15:30
CONCURRENT TECH. SESSIONS	15:30 - 17:10
DINNER AND RIVER CRUISE	18:30 - 20:30

THURSDAY, SEPTEMBER 5, 2019

REGISTRATION	08:00 - 20:00
PLENARY SESSION - 2	08:45 - 10:15
TEA BREAK	10:15 - 10:30
CONCURRENT TECH. SESSIONS	10:30 - 12:30
CONFERENCE LUNCH	12:30 - 13:30
CONCURRENT TECH. SESSIONS	13:30 - 15:10
TEA BREAK	15:10 - 15:30
CONCURRENT TECH. SESSIONS	15:30 - 17:10
POSTER SESSION	17:15 - 20:30
BUFFET DINNER	18:00 - 19:30

FRIDAY, SEPTEMBER 6, 2019

REGISTRATION	08:00 - 10:30
PLENARY SESSION - 3	08:45 - 10:15
TEA BREAK	10:15 - 10:30
CONCURRENT TECH. SESSIONS	10:30 - 12:30
AWARDS LUNCHEON	12:30 - 13:30

PLENARY SPEAKERS

WEDNESDAY, SEPTEMBER 4, 2019

Mr. Steven Winberg

Assistant Secretary for Fossil Energy, Department of Energy, USA

"Coal: A Perspective from the Department of Energy"

Dr. Steven Carpenter

Director, Enhanced Oil Recovery Institute, USA

"45Q: A Comparison of CO₂ Storage Quantification Methodologies"

Dr. John Deskins

Director, Bureau of Business and Economic Research; Assistant Dean for Outreach and Engagement; Associate Professor, Economics, West Virginia University, USA

"The Appalachian Coal Economy"

THURSDAY, SEPTEMBER 5, 2019

Prof. Yuemin ZHAO

Vice President, China University of Mining and Technology, CHINA

"Research Progress in Dry Beneficiation"

Dr. Ahmed Aboudheir

President, Aboudheir Consulting Ltd., CANADA

"An Optimum Solution for Coal Power Plants to Reduce CO₂ Emissions"

Dr. Alberto Pettinau

Scientific Director, Sotacarbo S.p.A., Grande Miniera di Serbariu, ITALY

"Power Generation from Fossil Fuels and Biomass: An International Collaboration Towards Low Carbon Energy"

FRIDAY, SEPTEMBER 6, 2019

Dr. Brian Anderson

Director, National Energy Technology Laboratory (NETL) - Department of Energy, USA

"Accelerating Breakthrough Innovation in Clean Coal Technologies"

Prof. Robert Finkelman

University of Texas, USA

"The Impact of Coal on the Most Important Component of the Environment: People"

Prof. Tarunjit S. Butalia

Department of Civil, Environmental, and Geodetic Engineering, The Ohio State University, USA

"Utilization of Coal Ash: Current Status & Future Outlook"

GENERAL INFORMATION

TECHNICAL TOUR

Longview Power, LLC

1375 Fort Martin Road, Moundsville, WV 26541

Tuesday, September 3, 2019

08:00 - 08:15	Shuttle Pickup at Westin Hotel
09:45 - 10:00	Arrive at Longview Power Plant
10:00 - 11:30	Technical tour
11:45 - 12:45	Lunch
13:00	Depart
14:30	Arrive at Westin Hotel

Cost: \$40.00 USD per person (The Technical Tour fee is NOT included in your conference registration fee.)

Registration Deadline

August 20, 2019 - International Attendees (Non-US)

August 27, 2019 - US Attendees

The Longview Power Plant is the newest, cleanest, most efficient coal-fired power plant in the 13-state PJM Interconnection and one of the most efficient in the United States, producing 700 net megawatts of electric power. Longview's best-in-class heat rate of 8,750 Btu/kwh far surpasses that of all other coal-fired power plants in the North America. Longview's advanced supercritical boiler, low cost fuel source and other project efficiencies combine to produce the lowest cost of dispatch (delivery of electricity) of any coal-fired plant in the region. Longview Power is a clean coal facility with best-in-class air pollution control systems that result in much lower emissions than its permit limits, which are among the lowest in the nation for coal plants. In addition, Longview emits significantly less CO₂ than most other coal plants because of its high energy conversion efficiency.

Dress Code: The plant is a functioning power plant. Visitors should wear clothes that are more like work clothes than business attire. Hard hats and safety glasses will need to be worn. Shoes should be sturdy for walking and not have open toes or cloth covering. Those who need prescription glasses to see should consider bringing their own safety glasses rather than rely on the plastic cover glasses provided by the Plant.

Registration:

Register on the PCC website <http://www.pccpitt.org>

UNIVERSITY-INDUSTRY FOSSIL ENERGY FORUM

Wednesday, September 4, 2019

10:30 am - 12:30 pm

The 36th Annual International Pittsburgh Coal Conference is proud to present for the first time the **University-Industry Fossil Energy Forum**. The forum is an open discussion and information exchange between universities and industries on their roles in meeting national/global needs. The focus of this first Forum is to improve the collaboration between US universities and industries in responding to workforce needs, conducting joint research, and providing recommendations to governmental units regarding the use of coal, natural gas, and petroleum (and products related to these resources). In future Forums, the program will include an international focus.

This Forum will be moderated by **Prof. Richard A. Bajura**, Director Emeritus, National Research Center for Coal and Energy (NRCCE), West Virginia University.

The participating panelists are:

Prof. Rodney Andrews

Associate Vice President for Research Development / Director, Kentucky Center for Applied Energy Research,
University of Kentucky

Ms. Shannon Angielski

Executive Director, Carbon Utilization Research Council

Mr. Daniel Connell

Vice President, Business Development & Technology, CONSOL Energy, Inc.

Prof. Ben Ebenhack

Chair of Environmental Engineering, Petroleum Engineering & Geology, Marietta College

Dr. Michael Karmis

Director, Virginia Center for Coal & Energy Research, Virginia Tech

Dr. Andrew Maxson

Program Manager, Electric Power Research Institute

Patrick Henderson

Marcellus Shale Coalition

Prof. Jason Trembly

Professor of Mechanical Engineering, Director of Ohio University Institute for Sustainable Energy and Environment, Ohio University

PROGRAM SCHEDULE

		Cambria East	Fayette	Somerset West	Somerset East	Washington
Wednesday (09/04/2019)	8:30 - 8:45	Opening Ceremony				
	8:45 - 9:10	Plenary Speaker - 1				
	9:10 - 9:35	Plenary Speaker - 2				
	9:35 - 10:00	Plenary Speaker - 3				
	10:00 - 10:15	Q&A				
	10:15 - 10:30	Morning Tea				
	10:30 - 12:30	Industry-University Fossil Energy Forum				
	12:30 - 13:30	Lunch				
	13:30 - 13:50	Clean Coal and Gas to Fuels - 1 (Session 1)	Gasification Technologies - 1 (Session 2)	Power Plants - 1 (Session 3)	Coal Science - 1 (Session 4)	Value-Added Products from Coal - 1 (Session 5)
	13:50 - 14:10					
	14:10 - 14:30					
	14:30 - 14:50					
	14:50 - 15:10					
	15:10 - 15:30	Afternoon Tea				
15:30 - 15:50	Clean Coal and Gas to Fuels - 2 (Session 6)	Gasification Technologies - 2 (Session 7)	Power Plants - 2 (Session 8)	Coal Science - 2 (Session 9)	Value-Added Products from Coal - 2 (Session 10)	
15:50 - 16:10						
16:10 - 16:30						
16:30 - 16:50						
16:50 - 17:10						
Thursday (09/05/2019)	8:40 - 8:45	Opening Session				
	8:45 - 9:10	Plenary Speaker - 1				
	9:10 - 9:35	Plenary Speaker - 2				
	9:35 - 10:00	Plenary Speaker - 3				
	10:00 - 10:15	Q&A				
	10:15 - 10:30	Morning Tea				
	10:30 - 10:50	Coal Ash Management - 1 (Session 11)	Gasification Technologies - 3 (Session 12)	Rare Earth Elements - 1 (Session 13)	Carbon Management - 1 (Session 14)	Coal Mining, Preparation and Handling - 1 (Session 15)
	10:50 - 11:10					
	11:10 - 11:30					
	11:30 - 11:50					
	11:50 - 12:10					
	12:30 - 13:30	Lunch				
	13:30 - 13:50	Coal Ash Management - 2 (Session 16)	Gasification Technologies - 4 (Session 17)	Rare Earth Elements - 2 (Session 18)	Carbon Management - 2 (Session 19)	Coal Bed and Shale Gas - 1 (Session 20)
	13:50 - 14:10					
14:10 - 14:30						
14:30 - 14:50						
14:50 - 15:10						
15:10 - 15:30	Afternoon Tea					
15:30 - 15:50	Coal Ash Management - 3 (Session 21)	Gasification Technologies - 5 (Session 22)	Rare Earth Elements - 3 (Session 23)	Combustion Technologies - 1 (Session 24)	Clean Coal Demonstration and Commercial Projects - 1 (Session 25)	
15:50 - 16:10						
16:10 - 16:30						
16:30 - 16:50						
16:50 - 17:10						
17:15-20:30	Poster Session					
Friday (09/06/2019)	8:40 - 8:45	Opening Session				
	8:45 - 9:10	Plenary Speaker - 1				
	9:10 - 9:35	Plenary Speaker - 2				
	9:35 - 10:00	Plenary Speaker - 3				
	10:00 - 10:15	Q&A				
	10:15 - 10:30	Morning Tea				
	10:30 - 10:50	Carbon Management - 3 (Session 26)	Coal Science - 3 (Session 27)	Value-Added Products from Coal - 3 (Session 28)	Combustion Technologies - 2 (Session 29)	Clean Coal Demonstration and Commercial Projects - 2 (Session 30)
	10:50 - 11:10					
	11:10 - 11:30					
	11:30 - 11:50					
	11:50 - 12:10					
12:30 - 13:30	Awards Luncheon					

CONFERENCE VENUE

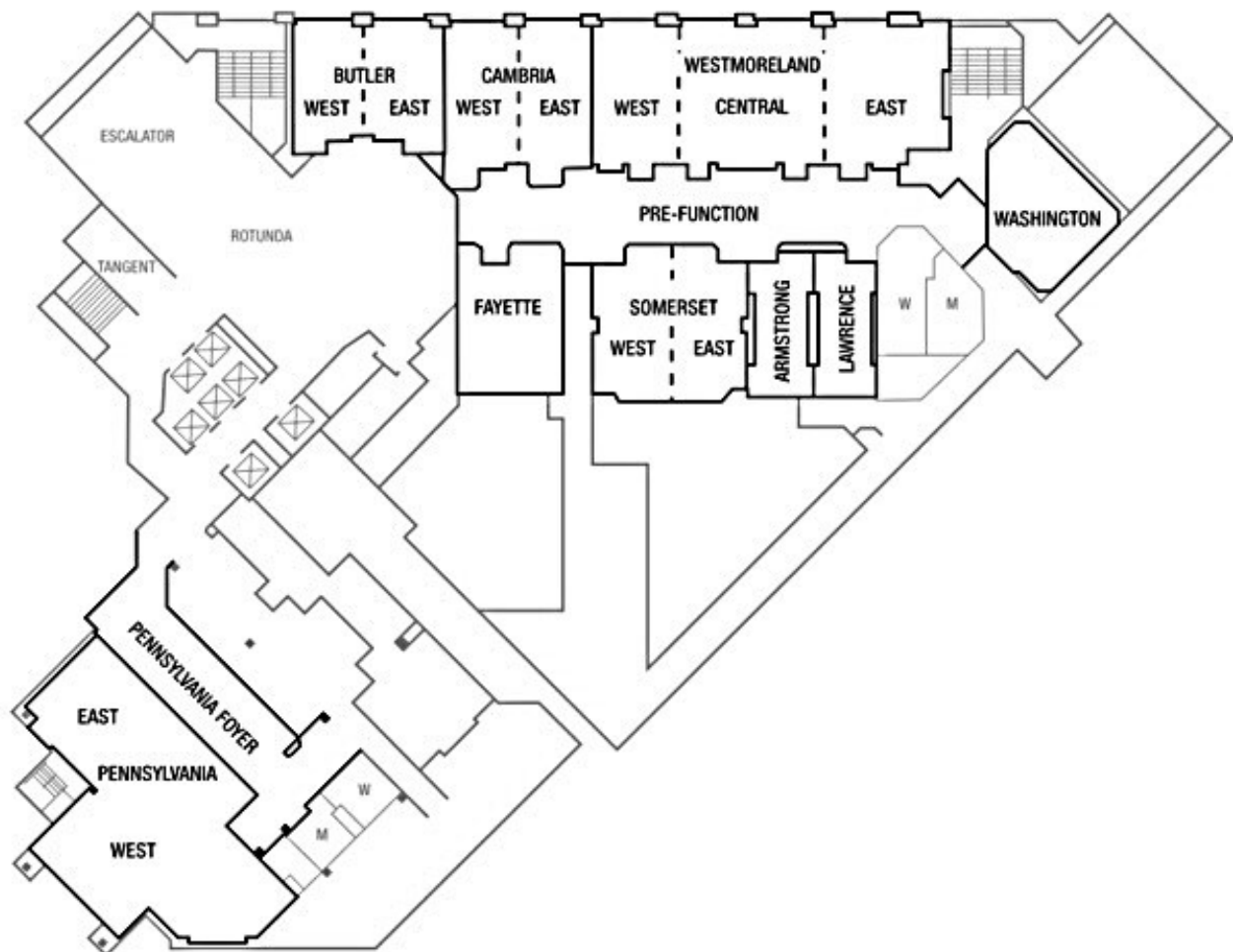
Westin Convention Center Hotel

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SECOND FLOOR



TECHNICAL PROGRAM

ORAL SESSIONS

Wednesday, September 4

13:30-17:10

SESSION 1

CLEAN COAL AND GAS TO FUELS - I: LIQUEFACTION AND FISCHER-TROPSCH

John Duddy, Diane Revay Madden

13:30 - 13:50 Low GHG Emitting Fisher Tropsch Process in Supercritical CO₂ with Integrated Recycle, Kanchan Mondal, Southern Illinois University, USA.

13:50 - 14:10 Fischer Tropsch Synthesis Like Process on Commercially Available O-Functionalized CNTs, Kanchan Mondal, Saikat Talapatra, Southern Illinois University; Mauricio Terrones, Pennsylvania State University; Praveen Alagiri, Southern Illinois University, USA.

14:10 - 14:30 Enhanced Direct Coal Liquefaction with CO₂ Capture, John Duddy, HTI, USA.

14:30 - 14:50 Preparation Characterization and Liquefaction Properties of Fe₇S₈, Ruo-qing Wang, Xiaohong Li, Hai-jie Li, Jie Feng, Wen-ying Li, Taiyuan University of Technology, CHINA.

14:50 - 15:10 The Effects of Hydrothermal Treatment on Structures and Liquefaction Behaviors of Lignite, Huan Li, Shiyong Wu, Youqing Wu, Sheng Huang, Jinsheng Gao, East China University of Science and Technology, CHINA.

SESSION 2

GASIFICATION TECHNOLOGIES - I

Gary Stiegel, Johan van Dyk

13:30 - 13:50 Overview of DOE Coal Gasification R&D, Jai-woh Kim, Dave Lyons, Regis Conrad, US Department of Energy, USA.

13:50 - 14:10 Innovative, Modular, and Flexible Coal-based Energy Systems, K. David Lyons, National Energy Technology Laboratory, USA.

14:10 - 14:30 Advanced Syngas Cleanup for Radically Engineered Modular Systems, Atish Kataria, RTI International, USA.

14:30 - 14:50 R-GAS Gasification Technology and Demonstration Project Status, Eric Z. Zhou, Gas Technology Institute, USA.

14:50 - 15:10 The Development of ECUST OMB Coal-Water Slurry Gasification Technology with Radiant Syngas Cooler, Qinghua Guo, Jianliang Xu,

Yan Gong, Guangsuo Yu, East China University of Science and Technology, CHINA.

SESSION 3

POWER PLANTS - I

Ting Wang, Nick Siefert

13:30 - 14:10 Supercritical Carbon Dioxide (sCO₂) Based Power Cycles in Fossil Fueled Power Plants, Richard Dennis, National Energy Technology Laboratory (NETL), USA.

14:10 - 14:30 Legal Update on Hydrologic Connection Cases Under the Clean Water Act, Hollister A. Hill, at Troutman Sanders, USA.

14:30 - 14:50 Comparison of an Integrated Mild/Partial Gasification Combined (IMPGC) Cycle with Other Power Cycles, Henry A. Long, III; Ting Wang; University of New Orleans, USA.

SESSION 4

COAL SCIENCE - I

Leslie Ruppert, Atsushi Ishihara

13:30 - 13:50 Separation Mechanism of Fine Coal Particles in Vibrated Fluidized Bed, Liang Dong, Xuchen Fan, Yuemin Zhao, China University of Mining and Technology, CHINA.

13:50 - 14:10 Fluidization Characteristics and Separation Performance of an Air Dense Medium Fluidized Bed for Coal Cleaning Based on Secondary Air Distribution Layer, Jingfeng He, Yuemin Zhao, China University of Mining and Technology, CHINA.

14:10 - 14:30 Strategies on Coking Coal Utilization: A Key to Sustainable Development in Jharia Coalfield, India, Ashok K. Singh, Pradeep K. Singh, CSIR-CIMFR, INDIA.

14:30 - 14:50 Operation Performance of FINEX® Process on the Different Reducing Agents, Jae Dong Kim, Jin Ho Ryu, Woo Il Park, Do Hyung Kim, Min Young Cho, POSCO Technical Research Lab, SOUTH KOREA.

14:50 - 15:10 Influence of Electrochemical Action During Electroflotation on Flotability of Shenmu Coal Macerals, Anning Zhou, Wei Zhao, Xian University of Science and Technology, CHINA

SESSION 5

VALUE-ADDED PRODUCTS FROM COAL - I: BUILDING MATERIALS

Chunshan Song, Haim Cohen

13:30 - 13:50 Carbon Fiber from Coal Tar Pitch, Matthew Weisenberger, University of Kentucky Center for Applied Energy Research, USA.

13:50 - 14:10 The Effect of Coal-Derived Graphene Nanomaterials in Cementitious Materials, Yuan Gao, Viet Hung Pham, National Energy Technology Laboratory and Leidos Research Support Team; Richard E. Spaulding, National Energy Technology Laboratory; Jennifer Weidman, Congjun Wang, National Energy Technology Laboratory and Leidos Research Support Team; Barbara Kutchko, Christopher S. Matrana, National Energy Technology Laboratory; USA.

14:10 - 14:30 Coal Plastic Composite Materials for Construction Applications, Yahya Al-Majali, Jason Trembly, Ohio University; Keerti S. Kappagantula, Pacific Northwest National Laboratory; Clive Chirume, Samuel Forshey, Ohio University; USA.

14:30 - 14:50 Partial Replacement of Cement, Aggregates and Natural Sand by Treated Oil Shale Ash in Concrete Mixtures, Haim Cohen, Ben-Gurion University of the Negev; Yaniv Knop, Ariel University; Julio Subovich, Environmental Services Company Neot Hovav Industrial Council; ISRAEL.

14:50 - 15:10 Development of X-MAT® Coal Core Composites for Roofing Materials and Lithium Ion Battery Anode Applications, William Easter, Semplastics, USA.

SESSION 6

CLEAN COAL AND GAS TO FUELS - II

Diane Revay Madden, John Duddy

15:30 - 15:50 Promoter Effect on Methanation Activity of Nickel Catalyst Prepared by Impregnation-Co-Precipitation Method, Enkhsaruul Byambajav, Co-author: Buyan-ulzii Battulga, Oyunbileg Galindev, National University of Mongolia, MONGOLIA.

15:50 - 16:10 Effect of Preparation Method of CeO₂ Support on CO Methanation Performance, Anning Zhou, Ning Yan, Yagang Zhang, Zhiyuan Yang, Xi'an University of Science and Technology, CHINA.

16:10 - 16:30 Simultaneous Production of Syngas and High-Purity Hydrogen Using Calcium-Iron Based Oxygen Carriers for Chemical Looping Reforming Process, Vedant Shah, Deven Baser, L.-S. Fan, The Ohio State University, USA.

16:30 - 16:50 Theoretical Study on Mechanism of Hydrodeoxygenation of Dibenzofuran Catalyzed by Pt Based Catalyst, Zi-Zheng Xie, Xing-Bao Wang, Jie Feng, Wen-Ying Li, Taiyuan University of Technology, CHINA.

TECHNICAL PROGRAM

16:50 - 17:10 Selective Hydrogenation of CO₂ Over ZSM-5-Based Tandem Catalysts, Marc D. Porosoff, University of Rochester, USA.

SESSION 7

GASIFICATION TECHNOLOGIES - II

Rolf Maurer, Harvey Goldstein

15:30 - 15:50 Reactive Separation of H₂S from Syngas with Coproduction of Hydrogen and Elemental Sulfur Using Thermo-Catalytic Sulfur Capture Process, Kalyani Jangam, Sourabh Nadgouda, Lang Qin, Yu-Yen Chen, L.-S. Fan, The Ohio State University, USA.

15:50 - 16:10 Full-Scale Dry Solids Pump Testing Up to 500 Psi and Techno-Economic Evaluation When Installed in a Quench Gasifier, Timothy Saunders, Joseph Caravella, Gas Technology Institute; Greg Weber, University of North Dakota, USA; Christopher Higman, Higman Consulting, UK.

16:10 - 16:30 Preparation and Characterization of NiFeAl Oxygen Carrier for Coal Chemical Looping Combustion, Ze-Hua Wei, Jie-Ying Jing, Dao-Cheng Liu, Jie Feng, Wen-Ying Li, Taiyuan University of Technology, CHINA.

16:30 - 16:50 Process Analysis of Chemical Looping Coal Gasification for Dimethyl Ether Synthesis, Fanhe Kong, Mandar Kathe, Andrew Tong, Pengfei He, Liang-Shih Fan, The Ohio State University, USA.

16:50 - 17:10 Chemical Looping Gasification of Lignin with Bimetallic Oxygen Carriers, Jinhu Wu, Chinese Academy of Sciences, CHINA; Hanjing Tian, West Virginia University, USA; Jingli Wu, Zhiqi Wang, Tao He, Jiangqing Li, Jinzhi Li, Chinese Academy of Sciences, CHINA; Jarrett Riley, Ranjani Siriwardane, National Energy Technology Laboratory, USA.

SESSION 8

POWER PLANTS - II

Massood Ramezan, Ting Wang

15:30 - 15:50 Development of a Mild Gasification Model for Use in an Integrated Mild/Partial Gasification Combined (IMPGC) Cycle, Henry A. Long, III; Ting Wang; University of New Orleans, USA.

15:50 - 16:10 Generation Efficiency Enhancements by Non-Ablative Fouling Control Coatings, Vinod Veedu, Matthew Nakatsuka, Erika Brown, Oceanit, USA.

16:10 - 16:30 Coal-Fired Direct Injection Carbon Engine (DICE) and Gas Turbine Compound-Reheat Combined Cycle (GT

CRCC), S. C. Gülen, Bechtel Infrastructure & Power, Inc., USA.

16:30 - 16:50 Dynamic Modeling and Control Strategies for Flexible Operation of a 10 MWe Supercritical CO₂ Recompression Closed Brayton Cycle, Stephen E. Zitney, Jacob T. Albright, Gaurav Mirlekar, Eric A. Liese, National Energy Technology Laboratory, USA.

SESSION 9

COAL SCIENCE - II

Atsushi Ishihara, Leslie Ruppert

15:30 - 15:50 The Yampa Coalfield, Northwestern Colorado, USA- A Western U.S. Analogue of the Appalachian Fire Clay Coal?, Allan Kolker, Brian N. Shaffer, Leslie F. Ruppert, Clint Scott, U.S. Geological Survey; Charles N. Thompson, Thompson Geo Service, Inc.; USA.

15:50 - 16:10 Value Addition of Low Rank and Heat Affected Indian Coals for Preparation of Metallurgical Grade Coal by Blending: a Case Study, Prabal Boral, Bodhisatwa Hazra, Ashok K Singh, CSIR-CIMFR, Pradeep K Singh, CSIR-CIMFR, INDIA.

16:10 - 16:30 Three Dimensional Aggregated Structural Model of Coking Coal, Yuki Hata, Yoichi Matsuzaki, Takafumi Takahashi and Koji Kanehashi, Advanced Technology Research Laboratories Nippon Steel & Sumitomo Metal Corporation, JAPAN.

16:30 - 16:50 Photocatalytic Degradation of Aqueous Colored Chemicals Using Titania and Zirconia-Tellurite Glasses, Atsushi Ishihara, Riko Itou, Ayano Fujita, Tadanori Hashimoto, Hiroyuki Nasu, Mie University, JAPAN.

SESSION 10

VALUE ADDED PRODUCTS FROM COAL - II

Zhiyuan Yang, Evan Granite

15:30 - 15:50 Opportunities and Challenges for A Domestic High-Value Coal Products Industry, Sujit Das, Oak Ridge National Laboratory, USA.

15:50 - 16:10 Preparation of Graphene Oxide-Enhanced Porous Carbon and Its Gas Adsorption Properties, Zhiyuan Yang, Zhuoyue Meng, Hongbin Liao, Jingjing Zhao, Hailong Ning, Xi'an University of Science and Technology, CHINA.

16:10 - 16:30 Towards Continue Manufacturing of Coal-Based Thin Films for

Electronics, Sensing and Energy Storage, Nicola Ferralis, Jeffrey C. Grossman, MIT, USA.

16:30 - 16:50 Brief Review of Thermal Graphitization of Coals and Carbons, Evan J. Granite, National Energy Technology Laboratory, USA.

16:50 - 17:10 Supercritical CO₂ Driven Production of Graphene and Aromatic Liquids for CNT, Kanchan Mondal, Southern Illinois University, USA.

17:10-17:30 Investigations on Product Distribution and Oxygen Removal in the Newly Two-Stage Catalytic Lignite Liquefaction Process, Runze Zhao, Sheng Huang, Youqing Wu, Shiyong Wu, Jinsheng Gao, East China University of Science and Technology, CHINA

ORAL SESSIONS

Thursday, September 5

10:30 -17:10

SESSION 11

COAL ASH MANAGEMENT - I

Tarunjit Butalia

10:30 - 10:50 Alternative Coal Ash Disposal Option for Stabilizing Ash and Wastewater for Power Plants and for Ash Relocation, Dale Timmons, NAES Corporation, USA.

10:50 - 11:10 Stabilizing Wet Coal Ash: The Current State of the Practice, Greg Landry, Paul Schmall, Moretrench, A Keller Company, USA.

11:10 - 11:30 Reducing Corrective Actions Through Modeling and Geochemistry, Ernie Stine, APTIM, USA.

11:30 - 11:50 Applications of Environmental Risk Assessment in Coal Ash Management, Matt Huddleston, SynTerra Corporation, USA.

11:50 - 12:10 Preparation of High Efficiency Potassium Calcium Silicate Fertilizer by Using the Fly Ash, Aiguo Chen, Xiaohuan Wang, Yongfeng Xiao, Huidong Liu, Xiaolin Jiang, Wenhua Li, National Institute of Clean-and-Low-Carbon Energy, CHINA.

TECHNICAL PROGRAM

SESSION 12

UNDERGROUND GASIFICATION

Harvey Goldstein, Rolf Maurer

10:30 - 10:50 Groundwater Monitoring During Mining of Coal In-Situ by Means of an Underground Coal Gasification Process, JC van Dyk, African Carbon Energy, North-West University; J Brand, African Carbon Energy; CA Strydom, FB Waanders, North-West University; South Africa.

10:50 - 11:10 Evolution of Underground Coal Gasification, Burl E. Davis, Consultant, USA.

11:10 - 11:30 Diffusion Effect and Evolution of Kinetic Parameters During Coal Char-CO₂ Gasification, Dexi Meng, Xueli Chen, Tian Wang, Jianliang Xu, East China University of Science and Technology, CHINA.

11:30 - 11:50 CPFD Simulation on Particle Behavior in an Entrained-Flow Gasifier, Yongshi Liang, Cliff Y. Guo, National Institute of Clean-and-low-carbon Energy, CHINA.

SESSION 13

RARE EARTH ELEMENTS - I: RECOVERY OF RARE EARTHS I

Evan Granite, Fred McLaughlin

10:30 - 10:50 Rare Earth Elements and Critical Materials from Coal-Based Resources, Mary Anne Alvin, National Energy Technology Laboratory, USA.

10:50 - 11:10 Adsorption of Critical Rare Earth Elements on ETS-10 Titanosilicate, Jay Thakkar, Blaine Wissler, Nick Dudenas, Xinyang Yin, Xueyi Zhang, The Pennsylvania State University, USA.

11:10 - 11:30 Recovery of Rare Earth Elements from Coal Seam Underclay, Scott N. Montross, LRST/National Energy Technology Laboratory; Circe A. Verba, US-DOE-NETL; Jon Yang, ORISE; Jinesh Jain, Sr., LRST/National Energy Technology Laboratory; Mark L. McKoy, US-DOE-NETL; USA.

11:30 - 11:50 Low-Cost Methods for Rare Earth Elements Extraction and Recovery from Coal-Waste, Michael L. Free, Prashant K. Sarswat, Landon Allen, Aaron Noble, and Gerald Luttrell, University of Utah, USA.

11:50 - 12:10 Rare Earth Elements in Acid Mine Drainage Precipitates: Results of A Regional Survey, Paul F. Ziemkiewicz, West Virginia University; Aaron Noble, Virginia Tech; Chris Vass, West Virginia University; USA.

SESSION 14

CARBON MANAGEMENT I: PILOT DEMONSTRATIONS

Nick Siefert, Steve Carpenter

10:30 - 10:50 Ratemaking & New Technology: A Regulatory Innovative Approach to Carbon Capture Projects, Kara B. Fornstrom, Wyoming Public Service Commission, USA.

10:50 - 11:10 Pilot Unit Testing of Alkalized Alumina Based Carbon Capture, Jeannine Elliott, Fei Yi, Brad Spatafore, TDA Research Inc., USA.

11:10 - 11:30 Pilot Testing of Amine-Based Solvent at Low-Rank Coal-Fired Power System, Jason D. Laumb, Principal Engineer, John P. Kay, David J. Dunham, Bruce C. Folkedahl, University of North Dakota, USA; Keisuke Iwakura, Tatsuya Tsujiuchi, Takashi Kamijo, Mitsubishi Heavy Industries, JAPAN; Tim Thomas, Mike Fowler, Osamu Miyamoto, Mitsubishi Heavy Industries America Inc., USA.

11:30 - 11:50 Pilot Scale Testing of Hydrophobic Solvents for Precombustion CO₂ Capture, Nicholas Siefert, National Energy Technology Laboratory, Carnegie Mellon University; Wei Shi, Robert Thompson, David Hopkinson, National Energy Technology Laboratory; Michael Swanson, Joshua Stanislawski, University of North Dakota Energy and Environmental Research Center, USA.

11:50 - 12:10 Initial Testing and Technology Update from the Wyoming Integrated Test Center, William James Morris, Wyoming Integrated Test Center; Jason Begger, Wyoming Infrastructure Authority, USA.

SESSION 15

COAL MINING, PREPARATION AND HANDLING

Richards Winschel, Daniel Connell

10:30 - 10:50 The Omnis Separation Plant; Transforming Coal Waste into High-Value Products, Greg Smith, Omnis Energy, USA.

10:50 - 11:10 Opportunities to Advance Coal through "Upstream" Technology Development in Mining and Beneficiation, Daniel P. Connell, CONSOL Energy Inc., USA.

11:10 - 11:30 Study on Fluidization Characteristics of Geldart D Particles Based on Analysis of Impact Force in a Vibrated Gas-Fluidized Bed, Song Wang, Liang Dong, Bo Zhang, Yuemin Zhao, Xuliang Yang, China University of Mining and Technology, CHINA.

11:30 - 11:50 Modelling New Scheme on Coal Procurement for Coal-Fired Power Plants in Indonesia, Firly R. Baskoro, Keisuke Nagasawa, Katsumi Morikawa, Katsuhiko Takahashi, Hiroshima University, JAPAN.

11:50 - 12:10 Coal Dust Treatment Technology for Coking Coal Moisture Control, Hamyung Jeong, JeaHoon Choi, POSCO, SOUTH KOREA.

12:10 - 12:30 Influence of Gas Compressibility on a Burning Accident in an Obstructed Coalmining Passage, Furkan Kodakoglu, V'yacheslav Akkerman, West Virginia University; Sinan Demir, Georgia Institute of Technology; USA.

SESSION 16

COAL ASH MANAGEMENT - II

Tarunjit Butalia

13:30—15:10 The Innovative Process of Harvesting Fly Ash from a Closed Pennsylvania Landfill for Beneficial Use, Angie Gerdeman, Hull & Associates; Ivan Diaz Loya, Boral CM Services LLC; Farshad Rajabipour, Penn State University; Tarunjit Butalia, The Ohio State University; William Petruzzi, Hull & Associates, Inc.; USA.

SESSION 17

PYROLYSIS I

Diane Revay Madden, Francis Lau

13:30 - 13:50 Development of Internal Surface Area During Pyrolysis and Gasification of Low-Rank Coals, Sittichai Natesakhawat, Evan Granite, National Energy Technology Laboratory, USA.

13:50 - 14:10 Gasification Characteristics and Kinetics Analysis of Rapid Co-Pyrolysis Char from Lignite and Cotton Straw, Qing He, Guangsuo Yu, Qinghua Guo, Juntao Wei, Jianliang Xu, Yifei Wang, East China University of Science and Technology, CHINA.

14:10 - 14:30 Hydrogen Balance for Co-Pyrolysis of Lignite and Different Hydrogen-Rich Additions, Yanling Li, Sheng Huang, Youqing Wu, Shiyong Wu, Jinsheng Gao, East China University of Science and Technology, CHINA.

14:30 - 14:50 Study on Lignin Pyrolysis Based on IT-PY-GC/MS/SIM, Fuxin Chen, Junxing Zhang, Feiyang Duan, Anning Zhou, Xian University of Science and Technology, CHINA.

14:50 - 15:10 Integrated Low Carbon Alkanes Activation with Coal Pyrolysis for Improving Coal Tar Yield, Haoquan Hu, Lijun Jin, Yang Li, Dalian University of Technology, CHINA.

TECHNICAL PROGRAM

SESSION 18

RARE EARTH ELEMENTS - II: CHARACTERIZATION AND ANALYTICAL METHODS OF RARE EARTHS

Mary Anne Alvin, Evan Granite

13:30 - 13:50 Using Yttrium as an Indicator to Estimate Total Rare Earth Element Concentration: A Case Study on the Rare Earth Element Distribution Patterns of Coal-associated Clays from Eastern Pennsylvania, Xiaojing Yang, Daniel Kozar, The Pennsylvania State University; Daniel Gorski, Anthony Marchese, Texas Minerals Resource Corporation; James Pagnotti, Pagnotti Enterprises; Rusty Sutterlin, Inventure Renewables, Inc.; Mohammad Rezaee, Mark S. Klima, Sarma V. Pisupati, The Pennsylvania State University; USA.

13:50 - 14:10 Microanalytical Characterization of Rare Earth Elements in Coal-associated Clays, Circe Verba, US-DOE-NETL; Jon Yang, ORISE; Scott Montross, LRST/National Energy Technology Laboratory; Christina Lopano, US-DOE-NETL; Mengling Stuckman, LRST/National Energy Technology Laboratory; Mark L. McKoy, US-DOE-NETL; USA.

14:10 - 14:30 Characterization and Recovery of Rare Earth Elements from Powder River Basin Coal Ash, Mengling Stuckman, Christina Lopano, National Energy Technology Laboratory; Benjamin Hedin, Oak Ridge Institute of Science and Education; Bret Howard, Evan Granite, U.S. Department of Energy, National Energy Technology Laboratory; USA.

14:30 - 14:50 Characterization of Rare Earth Elements in Coal Mine Drainage Treatment Solids, Benjamin Hedin, Oak Ridge Institute of Science and Education, Mengling Stuckman, Christina Lopano, National Energy Technology Laboratory; Rosemary Capo, University of Pittsburgh; USA.

14:50 - 15:10 Quantitative Rare Earth Elemental Analysis by Laser-Induced Breakdown Spectroscopy, Samuel M. Clegg, Ann Ollila, Adriana Reyes-Newell, Zhenghua Li, Los Alamos National Laboratory, USA.

SESSION 19

CARBON MANAGEMENT -II

Steve Carpenter, Nick Siefert

13:30 - 13:50 Status of Technology Development at the National Carbon Capture Center, Doug McCarty, Southern Company, USA.

13:50 - 14:10 CCUS (CO₂-EOR), ISO 27916, & 45Q: Wyoming's Triple Threat –

the Cowboy Unicorn, Steven M. Carpenter, University of Wyoming, USA.

14:10 - 14:30 A Comparison of CO₂ Storage Quantification Methodologies, George Koperna, Advanced Resources International, Inc.; Michael Godec, Advanced Resources International, Inc.; Steven M. Carpenter, University of Wyoming, USA.

14:30 - 14:50 Regional Economic Impacts of Carbon Capture and Sequestration, Joshua J. Stanislawski, University of North Dakota; Steven M. Schlasner, Bruce C. Folkedahl, Michael L. Swanson, and Melanie D. Jensen, University of North Dakota, USA.

14:50 - 15:10 A Forward-Looking Assessment of Advanced Membrane Technology for Cost-Effective Post-Combustion Carbon Capture, Haibo Zhai, Carnegie Mellon University, USA.

SESSION 20

COAL BED METHANE AND SHALE GAS

Dan Connell, Richard Winschel

13:30 - 13:50 Global Coal Mine Methane and Coalbed Methane Developments, Clark Talkington, Advanced Resources International, Inc.; Valerie Askinazi, U.S. EPA Coalbed Methane Outreach Program; Kyeong Pil Kong, Advanced Resources International, Inc.; USA.

13:50 - 14:10 Impacts of Solution Composition and Temperature on Ra-226 Removal by Barite (Baso₄): Comparison of Experimental and Modeling Results, Alen Gusa, University of Pittsburgh; Hamid Al-Khashab, Joseph R. V. Flora, University of South Carolina; Radisav D. Vidic, University of Pittsburgh; USA.

14:10 - 14:30 Casing Stability for Gas Wells in Longwall Abutment Pillars of Active Mines and a Characterization of Migration Potential for a Hypothetical Well Breach, Steven J. Schatzel, V Gangrade, E Watkins, C Hollerich, J Addis, W Su, NIOSH/PMRD, USA.

14:30 - 14:50 Porosity and Fractal Dimensions of Lower Permian Barren Measures Organic-Shales, Damodar Valley, India, Bodhisatwa Hazra, Co-Authors: Ashok K. Singh, Pradeep K. Singh, CSIR-CIMFR; Pudi Srinivasa Rao, Koushik Mahanta, Tata Steel Limited; INDIA.

SESSION 21

COAL ASH MANAGEMENT - III

Tarunjit Butalia

15:30 - 15:50 Designing the Ash Beneficial Use Center, Benjamin Gallagher, Ken Ladwig, EPRI, USA.

15:50 - 16:10 Characterization of CCP Impoundments to Determine Suitability for Beneficial Use, Robb Erwin, Ross Gorman, The SEFA Group, USA.

16:10 - 16:30 Reclaiming and Recycling Coal Ash for Beneficial Use, Bill Fedorka, Robert Erwin, SEFA, USA.

16:30 - 16:50 Coal Ash in the Chesapeake Bay Watershed, Paul Petrick, Maryland Department of Natural Resources, USA.

16:50 - 17:10 Fly Ash Beneficiation Using Triboelectric Separation, Cesar A. Constantino, Separation Technologies LLC, a Titan America Business, USA; Lewis Baker, ST Equipment & Technology LLC, UK; Abhishek Gupta, Frank Hrach, ST Equipment & Technology LLC, USA.

SESSION 22

PYROLYSIS II

Francis Lau, Aleksander Sobolewski

15:30 - 15:50 An Approach for Quantifying Transferable Hydrogen in Pyrolyzing Coals, Koyo Norinaga, Nagoya University, Tetsuya Fukuoka, Hiroshi Machida, Wei Zhang, Nagoya University, JAPAN.

15:50 - 16:10 Syngas-Fired Allam Cycle Project Update, Joshua J. Stanislawski, Jason D. Laumb, University of North Dakota Energy & Environmental Research Center; Xijia Lu, Mike McGroddy 8 Rivers Capital, LLC; USA.

16:10 - 16:30 Steam Reforming of Toluene as a Tar Model Compound Over Ni/Biochar: The Effects of Inherent Potassium, Chen Xu, Zhen-yi Du, Hong-da Ma, Shi-qi Yang, Jie Feng, Wen-ying Li, Taiyuan University of Technology, CHINA.

16:30 - 16:50 Spectral Characteristics of Diesel and Coal Water Slurry Flames in an Entrained-Flow Gasifier, Huiwen Zhu, JiaBao Yang, Yan Gong, QingHua Guo, YiFei Wang, GuangSuo Yu, East China University of Science and Technology, CHINA.

16:50 - 17:10 Influence of CaO Modified In-Situ Bio-Char on the Co-Pyrolysis of Coal and Sludge, Jiaofei Wang, Guangsuo Yu, Xudong Song, Weiguang Su, Yonghui Bai, Ningxia University, CHINA.

TECHNICAL PROGRAM

SESSION 23

RARE EARTH ELEMENTS - III: RECOVERY OF RARE EARTHS II

Richard Winschel, Evan Granite

15:30 - 15:50 **Developing a Mine Reclamation Approach to Recover Rare Earth Elements from Acid Mine Drainage**, Chin-Min Cheng, Jeff Bielicki, John Lenhart, Professor, Tarunjit Butalia, The Ohio State University, USA.

15:50 - 16:10 **Recovery of Rare Earth Elements from Coal Fly Ash Leachates by Supported Liquid Membranes**, Heileen Hsu-Kim, Ryan C. Smith, Mark R. Wiesner, Duke University, USA.

16:10 - 16:30 **Electrochemical Recovery of Rare Earth Elements from Ohio Coal and Coal By-Products**, Gerardine G. Botte, Behnaz Jafari, Alamgir M. Haque, Xiang Lyu, Ohio University, USA.

16:30 - 16:50 **Thermal Recovery of REEs from Coal Ash**, Rod B. Vera, Technologies International Corporation; Howard McClintic, CTC Foundation; USA.

16:50 - 17:10 **Effect of Extractive Agent and Ca Content on Extractability of Rare Earth Minerals from Ca-Rich Coal Ash**, Ward Burgess, Megan Macala, National Energy Technology Laboratory and Leidos Research Support Team; Catherine Spencer, Bret Howard, Murphy Keller, National Energy Technology Laboratory; Ken Ladwig, Electric Power Research Institute; Evan Granite, National Energy Technology Laboratory; USA.

SESSION 24

COMBUSTION TECHNOLOGIES - I

Massood Ramezan, Johan van Dyk

15:30 - 15:50 **Improving Coal Fired Plant Performance Using a Coal Tracker Optimization Tool**, David Stadem, Steven Benson, Shuchita Patwardhan, James Langfeld, Mathew Fuka, Microbeam Technologies, Inc.; Travis Desell, Department of Software Engineering, Rochester Institute of Technology; USA.

15:50 - 16:10 **Computational Study of Staged Pressurized Oxy-Fuel Combustion of Methane and Pulverized Coal in a Lab-Scale Reactor**, Ansan Pokharel, Gideon Udochukwu, Vyacheslav Akkerman, West Virginia University; Co-Author: Pan Du, Zhiwei Yang, Richard L. Axelbaum, Washington University at St. Louis; USA.

16:10 - 16:30 **Sub-Micron Ash Aerosol Formation in Oxy-Coal Combustion at Atmospheric and Elevated Pressures**, Andrew P. Chiodo, Kevin A. Davis, Reaction Engineering International; Xiaolong Li,

Yueming Wang, Jost O. L. Wendt, University of Utah; USA.

16:30 - 16:50 **Experimental and Computational Studies on a Mediated Oxycombustion System**, Kanchan Mondal, Adam Sims, Hussein Al-Mrayate, Bal Krishna Adhikari, Quan Zhang, Southern Illinois University, USA.

16:50 - 17:10 **Influence of Coal Ash and Alkali Chloride on CuO-Based Oxygen Carriers for Chemical Looping with Oxygen Uncoupling**, Jinze Dai, Kevin J. Whitty, The University of Utah, USA.

17:10 - 17:30 **Characterization of Atomized Coal Slurry through Pintle Injector for Oxy-Fuel Combustion**, Ana Rios, Mohieminul Khan, Mehrin Chowdhury, Ahsan Choudhuri, The University of Texas at El Paso, USA.

SESSION 25

CLEAN COAL DEMONSTRATION AND COMMERCIAL PROJECTS I

Thomas Sarkus, Alberto Pettinau

15:30 - 15:50 **Building a Coal Based Energy System in Pakistan**, Farid A Malik, FC College A Chartered University, PAKISTAN.

15:50 - 16:10 **Making Coal Relevant for Small Scale Applications: Modular Gasification for Syngas/Engine CHP Applications in Challenging Environments**, Harvey Goldstein, Senior Project Manager, Worley Group, Inc.; Charles Ward, University of Alaska – Fairbanks; Rolf Maurer, Hamilton Maurer International, Inc. – Hudson; David Thimsen, Hamilton Maurer International, Inc. – St Paul; Brent J. Sheets, University of Alaska – Fairbanks; Randy Hobbs, Hobbs Industries, Inc.; Frances Isgrigg, Russell Steiger, University of Alaska – Fairbanks; Diane Revay Madden, USDOE National Energy Technology Center; USA; Alberto Pettinau, Sotacarbo S.p.A., ITALY.

16:10 - 16:30 **Ultralow Emissions for Coal Fired Power**, Geoffrey D. Bongers, Gamma Energy Technology P/L; Nikolai K. Kinaev, Strategic Energy Consulting P/L; Zvonko Pregelj, Altaprom International P/L; AUSTRALIA.

16:30 - 16:50 **FPO Flameless Pressurized Oxy-Combustion Industrial Development Progresses, and the Projected Change of Scenario from Global Warming to Industry De-Carbonization**, Massimo Malavasi, Itea S.p.A., ITALY; Richard Horner, University of Wyoming, USA.

16:50 - 17:10 **Challenges of Solid Handling in Low Rank Coal Pyrolysis Pilot Testing**, Cliff Y. Guo, National Institute of Clean-and-low-carbon Energy, CHINA.

ORAL SESSIONS

Friday, September 6

10:30 - 12:10

SESSION 26

CARBON MANAGEMENT III

Bingyun Li, Fred McLaughlin

10:30 - 10:50 **Reducing Energy Required for CO₂ Separation and Recovery Process by Employing Phase Separation Solvents**, Koyo Norinaga, Hitoshi Nishio, Tran Khuyen, Hiroshi Machida, Nagoya University, JAPAN.

10:50 - 11:10 **Modeling the Life Cycle Impacts of U.S. Coal Mining at a Regional Level**, Michelle Krynock, Derrick Carlson, Timothy J. Skone, National Energy Technology Laboratory, USA.

11:10 - 11:30 **Wyoming CarbonSAFE: Establishing a Commercial-Scale Carbon Storage Complex Feasibility Study at the Newest Coal-Fired Power Plant, Dry Fork Station, Wyoming**, J. Fred McLaughlin, Scott Quillinan, University of Wyoming, USA.

11:30 - 11:50 **Quantifying Water Impacts from Thermoelectric Power Plants for US States and Counties**, Joseph Chou, Derrick Carlson, Erik Shuster, National Energy Technology Laboratory, USA.

11:50 - 12:10 **Carbon Capture Utilization and Storage Provide a New Opportunity for Fostering Cleaner and More Sustainable Energy Future – an Integrated Low Carbon Economic Development Strategy for Fossil Energy Rich Regions in Wyoming and the Ordos Basin China**, Zunsheng Jiao, Kipp Coddington, Heng Wang, Fred McLaughlin, Scott Quillinan, University of Wyoming, USA.

SESSION 27

COAL SCIENCE - III: TRACE ELEMENTS AND PYROLYSIS

Allan Kolker, Atsushi Ishihara

10:30 - 10:50 **Thermal Desorption of Mercury and Sulfur from Coal using Spouted Bed Reactor**, Quang Truong, Srujan Rakkam, Advanced Cooling Technologies, Inc.; Carlos Romero, Zheng Yao, Lehigh University; USA.

10:50 - 11:10 **Heterogeneous Microscale and Nanoscale Arsenic and Selenium Speciation in Coal Fly Ash**, Heileen Hsu-Kim, Nelson A. Rivera, Duke University, USA.

TECHNICAL PROGRAM

11:10 - 11:30 **A Study of Mercury and other Trace Metals in Pyrite from Illinois Basin Coals Using LA-ICP-MS**, Clint Scott, Allan Kolker, U.S. Geological Survey; Liliana Lefticariu, Southern Illinois University; Maria Mastalerz, Agnieszka Drobniak, Indiana University; Alan Koenig, U.S. Geological Survey; USA.

11:30 - 11:50 **In-Situ Analysis and Theoretical Study of Vacuum Pyrolysis of N-Benzylaniline with Time-Of-Flight Mass Spectrometry**, Fanggang Liu, Gang Li, Haoquan Hu, Dalian University of Technology, CHINA.

SESSION 28

VALUE ADDED PRODUCTS FROM COAL - III

Kanchan Mondal, John Duddy

10:30 - 10:50 **Large Scale Synthesis of Coal-Derived Carbon-Based Nanomaterials**, Viet Hung Pham, Congjun Wang, Jennifer Weidman, Yuan Gao, National Energy Technology Laboratory, Leidos Research Support Team; Christopher Matranga, National Energy Technology Laboratory; USA.

10:50 - 11:10 **Recovering Semi-Coking Wastewater by Formaldehyde-Based Phenol Extraction**, Yali Wang, Jiajia Peng, Shuai Cao, Hua He, Yufei Wang, Long Yan, Yulin University, CHINA.

11:10 - 11:30 **Selective Oxidation via Engineered Core@Shell Catalysts: Principle and Application to Dehydrogenation of Ethane to Ethylene**, Yahui Yang, Eyrarn Akabua, Götze Vesper, University of Pittsburgh, USA.

11:30 - 11:50 **Conversion of Alkylphenol to Phenol over Hierarchical ZSM-5 Zeolites: Effects of Mesoporosity against the Deactivation**, Ting-sheng Chen, Zhen-yi Du, Wen-yi Yang, Di Liu, Jie Feng, Wen-ying Li, Taiyuan University of Technology, CHINA.

11:50 - 12:10 **Synthesis of Formaldehyde from Syngas via Catalytic Condensation in Functionalized Metal Organic Frameworks**, Lin Li, Sen Zhang, Jonathan Ruffley, University of Pittsburgh; Kushantha Withanage, Juan Peralta, Koblar Jackson, Central Michigan University; Karl Johnson, University of Pittsburgh; USA.

SESSION 29

COMBUSTION TECHNOLOGIES - II

Evan Granite, Francis Lau

10:30 - 10:50 **Control Scheme to Optimize Fluidized-Bed Combustion Sulfur-Capture Systems Through Integration of Fuel Properties**, David Stadem, Steven

Benson, Shuchita Patwardhan, Microbeam Technologies, Inc., USA.

10:50 - 11:10 **The Use of Gaseous Metal Oxide as an Oxygen Carrier in Coal Chemical Looping Combustion**, Quan Zhang, Debalina Dasgupta, Kanchan Mondal, Southern Illinois University, USA; Minhua Zhang, Tianjin University, CHINA; Tomasz Wiltowski, Southern Illinois University Carbondale, USA.

11:10 - 11:30 **Water Utility Lime Sludge Reuse for Flue Gas Desulfurization**, Justin Mock, Hafiz Salih, University of Illinois at Urbana-Champaign; Craig Patterson, U.S. EPA; Seyed A. Dastgheib, University of Illinois at Urbana-Champaign; USA.

11:30 - 11:50 **A Parametric Exploration of MILD Coal Combustion**, James C. Sutherland, Hang Zhou, Joshua McConnell, University of Utah, USA.

SESSION 30

CLEAN COAL DEMONSTRATION AND COMMERCIAL PROJECTS II

Alberto Pettinau, Thomas Sarkus

10:30 - 10:50 **Catalyst-promoted Solvent is the New Pathway to Reduce the Cost of CO₂ Capture from Coal Flue Gases**, Ahmed Aboudheir, President, Aboudheir Consulting Ltd; Maohong Fan, University of Wyoming; USA.

10:50 - 11:10 **Preliminary Study on Civilian Clean Briquette Production by Integrating with the Surplus Capacity of Power Plant**, Haohua Gao, Wandou Du, National Institute of Clean-and-Low-Carbon Energy, CHINA.

11:10 - 11:30 **Performance and Integrated Operation at the Kemper IGCC Facility**, Matt Nelson, Pannalal Vimalchand, Wan Wang Peng, Southern Company; Bruce Harrington, Mississippi Power Company; Tim Pinkston, Southern Company; Diane Madden, U. S. Department of Energy, National Energy Technology Laboratory; USA.

11:30 - 11:50 **The Osaki Coolgen Oxygen-Blown IGCC with CO₂ Capture Demonstration Project**, Yugo Ishizaki, OSAKI COOLGEN CORPORATION, JAPAN.

POSTER SESSIONS

Thursday, September 5

17:15 - 20:30

GT: GASIFICATION TECHNOLOGIES

GT-P1 **Bio-char and Ni-bio-char; a Sustainable Catalysts for Treatment of Tar from Co-gasification of Coal and Biomass in a Fluidised Bed Gasifier**, M. Ozonoh, T. C. Anioke, University of the Witwatersrand; B.O. Oboirien, University of Johannesburg; M.O. Daramola, University of the Witwatersrand; SOUTH AFRICA.

GT-P2 **Ca/Na Compounds Catalyzed Coal Pyrolysis and Char Gasification with H₂O**, Yonghui Bai, Guangsuo Yu, Xudong Song, Weiguang Su, Jiaofei Wang, Ningxia University, CHINA.

GT-P3 **Study on Carbon Residue Formation Mechanism in Coal Gasification Slagging Process Based on Spectral Visualization Analysis**, Xudong Song, Guangsuo Yu, Weiguang Su, Yonghui Bai, Jiaofei Wang, Doctor, Ningxia University, CHINA.

GT-P4 **An Experimental Study on High Temperature ESP Under Coal Pyrolysis Gas**, Quanlin Chen, Jianmeng Cen, Mengxiang Fang, Qinhui Wang, Zhejiang University, CHINA.

GT-P5 **Techno-Economic Analysis of Coal Dual-Bed Pyrolysis Polygeneration System Coupled with Pulverized Power Plant**, Kaikun Li, Qinhui Wang, Chunjiang Yu, Mengxiang Fang, Zhongyang Luo, Zhejiang University, CHINA.

GT-P6 **Isotopic Tracer Study of the Integrated Process of Coal Pyrolysis with Steam Reforming of Methanol**, Xin-fu He, Jun Zhou, Xiao-qin Zhang, An-ning Zhou, Zhi-yuan Yang, Xi'an University of Science & Technology, CHINA

CCD: CLEAN COAL DEMONSTRATION AND COMMERCIAL PRODUCTS

CCD - P1 **High Yield and Economical Production of Rare Earth Elements from Coal Ash**, Dorin V. Preda, Prakash B. Joshi, David P. Gamliel, Jeffrey Y. Yee, Russel D. Lambert, Physical Sciences Inc.; James C. Hower, John G. Groppo, Jr., Research Professor, University of Kentucky; Todd Bears, Mike Schrock, Winner Water Service; USA.

TECHNICAL PROGRAM

CT: COMBUSTION TECHNOLOGIES

CT-P1 Physicochemical Characteristics of Fine Particles Collected from WESP in a Coal-Fired Power Plant, Chong Tian, Wuhan University; Bengen Gong, Yongchun Zhao, Junying Zhang, Huazhong University of Science and Technology; CHINA.

CT-P2 Modification of Red Mud for the Removal of Mercury from Coal Combustion Flue Gases, Muhammad Sarfraz, Yang Li, Lixin Dang, Haoquan Hu, Dalian University of Technology, CHINA.

CT-P3 Copper Iron Oxide Modification Magnetosphere Catalyst from Fly Ash for Mercury Oxidation in Flue Gases, Yang Li, Lixin Dang, He Yang, Lijun Jin, Haoquan Hu, Dalian University of Technology, CHINA.

GF: CLEAN COAL AND GAS TO FUELS

GF-P1 Creation of Moderate Acidity in Ni₂P/SiO₂ for Efficient Hydrogenation of Naphthalene, Zhi-Fen Yang, Jie-Ying Jing, Dao-Chen Liu, Jiu-Zhan Wang, Zhi-Qang Qie, Jie Feng, Wen-Ying Li, Taiyuan University of Technology, CHINA.

CM: CARBON MANAGEMENT

CM-P1 Levelized Cost of CO₂ Captured Using Different Physical Solvents in Precombustion Applications, Husain Ashkanani, Rui Wang, University of Pittsburgh; Nicholas Siefert, Isaac Gamwo, Kevin Resnik, U.S. Department of Energy, National Energy Technology Laboratory; Kathryn Smith, Badie Morsi, University of Pittsburgh; USA.

CM-P2 Modeling of CO₂ Absorption from Gas Mixtures Using Chemical Absorbents in Adiabatic Packed-Beds, Rui Wang, Husain Ashkanani, University of Pittsburgh; Bingyun Li, West Virginia University; Badie Morsi, University of Pittsburgh; USA.

CM-P3 Postcombustion CO₂ Capture in a Countercurrent Packed-bed Absorbers using Monoethanolamine Aqueous Solutions, Sudesna Banerjee, Wang Rui, Husain Ashkanani and Badie Morsi University of Pittsburgh, USA.

CM-P4 The Influence of Aqueous H₂O₂ Oxidation of Columnar Activated Carbon (CAC) on Photocatalytic Performance of Ti₁/Li₃/Al₂-LDHs- CAC Composites in Reduction of CO₂ with Water, Anning Zhou, Ruiqi Li, Dongqiang Lei, Gaofeng Li, Xiaoling Zhao, Xi'an University of Science and Technology, CHINA.

CM-P5 Computational Modelling of Bulk ZIF-8 for Carbon Capture Applications, Hari P. Paudel, Wei Shi, David P. Hopkinson, Yuhua Duan, National Energy Technology Lab, USA.

CS: COAL SCIENCE

CS - P1 Low Rank Coal Upgrading and Separation Method and Slime Reduction Process Based on the Flip-Flow Screen Classification and Shallow Tank Heavy Medium Separator, Bo Zhang, Liang Dong, Xuchen Fan, Yuemin Zhao, China University of Mining and Technology, CHINA.

CS - P2 Effects of Different Acids on Solvent Extraction of REEs from Coal Ash, Daejin Kim, Mengling Y. Stuckman, Ward A. Burgess, Leidos Research Support Team, National Energy Technology Laboratory; Murphy, J. Keller, Gordon Chiu, Evan J. Granite, United States Department of Energy, National Energy Technology Laboratory; USA.

CMN: COAL MINING, PREPARATION, AND HANDLING

CMN-P1 In-Situ Testing and Data Applications for Upstream-Constructed Coal Refuse Impoundments, Abceera Batool, Blaise Genes, GAI Consultants, Inc, USA.

CB: COAL BED METHANE AND SHALE GAS

CB-P1 Macromolecular Model of Shenmu Coal and Its Molecular Mechanism of Methane Adsorption, Zhiyuan Yang, Yinyan Li, Xue wenyong, Xiaoyu Song, Zhiqiang Yin, Xi'an University of Science and Technology, CHINA.

CB-P2 The Ultra-low Concentration Coal-bed Methane Fluidized Bed Oxidized Combustion System and Its Technical and Economic Evaluation Under Carbon Trading Mechanism, Zhongqing Yang, Xiuquan Li, Li Zhang, Lin Ding, Yunfei Yan, Chongqing University, CHINA.

PP: POWER PLANTS

PP - P1 Situation and Discuss on Biomass Co-Combustion Technology for Power Generation in China, Shuaidan Li, China Huadian Electric Power Research Institute Co., LTD., Jie Xu, Qingdao Agricultural University; Huaxin Jiang, China Huadian Electric Power Research Institute Co., LTD., CHINA.

PP - P2 Economical Study on a 10MW Scale Biomass Indirect Co-Combustion with Coal for Power Generation, Shuaidan Li, China Huadian Electric Power Research Institute Co., LTD.; Jie Xu, Qingdao Agricultural University; Huaxin Jiang, China Huadian Electric Power Research Institute Co., LTD.; CHINA.

REE: RARE EARTH ELEMENTS (REE) IN FOSSIL FUEL DERIVED SOLIDS AND LIQUIDS

REE-P1 Rare-Earth Elements (REEs) in U.S. Coal-Based Resources: Sampling, Characterization, and Round-Robin Interlaboratory Study, Bruce C. Folkedahl, Christopher J. Zygarlicke, Carolyn M. Nyberg, Ian K. Feole, Energy & Environmental Research Center University of North Dakota; Steven A. Benson, Microbean Technologies Incorporated; James Hower, University of Kentucky; USA.

REE-P2 Rare Earth Element Occurrence and Distribution in Powder River Basin Coal Core, Wyoming, Davin Bagdonas, Charles Nye, University of Wyoming; Randal B. Thomas, LRST (Battelle), National Energy Technology Laboratory; Kelly K. Rose, National Energy Technology Laboratory; USA.

REE-P3 Rare and Rare Earth Elements in the Technogenic Waste of Thermal Power Enterprises in Primorsky Krai of the Russian Federation and Methods of Effective Reclamation, Tananaev I.G., Shapkin N.P., Taskin A.V., Elkin O.I., Far Eastern Federal University, RUSSIA.

REE-P4 Coal Ash Beneficiation Through Critical Material Extraction and Recovery, Clint Noack, Prachi Jain, Luke Meyers, Anactisis; Athanasios Karamalidis, Anactisis and Pennsylvania State University; USA.

REE-P5 Leaching Behavior of Rare Earth Elements from Anthracite Based Resources, Sarma V. Pisupati, Xiaojing Yang, Mohammad Rezaee, Mark S. Klima, The Pennsylvania State University, USA.

CAM: COAL ASH MANAGEMENT

CAM-P1 Semi-Dry Geopolymer Fly Ash Pellet Accelerating the Polymerization Process of Fly Ash by Microwave, Nghia Trung Tran, Trung Hau LTD.; Minh Quang Do, Ho Chi Minh City University of Technology; VIETNAM.

CAM-P2 Thermal Processing of CCR's, Rod B. Vera, Technologies International Corporation; Howard McClintic, CTC Foundation; USA.

TECHNICAL PROGRAM

VA: VALUE-ADDED PRODUCTS FROM COAL

VA-P1 Efficient Process for the Production of High Conductivity, Carbon-Rich Materials from Coal, Dorin V. Preda, Min K. Song, Jake T. Herb, David P. Gamliel, Tyler R. Paul, Christopher M. Lang, Physical Sciences Inc., USA.

VA-P2 Product Distributions and Characterizations for Integrated Mild-Liquefaction and Carbonization of Low Rank Coals, Sheng Huang, Yanling Li, Youqing Wu, Shiyong Wu, Jinsheng Gao, East China University of Science and Technology, CHINA.

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