

41st International Technical Conference on Clean Coal & Fuel Systems 2016

The Clearwater Clean Coal Conference

Clearwater, Florida, USA
5-9 June 2016

Editor:

Barbara A. Sakkestad

ISBN: 978-1-5108-2360-0

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



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

Copyright© (2016) by Coal Technologies Associates
All rights reserved.

Printed by Curran Associates, Inc. (2016)

For permission requests, please contact Coal Technologies Associates
at the address below.

Coal Technologies Associates
Post Office Box 1130
Louisa, Virginia 23093
USA

Phone: 540-603-2022

BarbaraSak@aol.com

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

Table of Contents

Chemical Looping I (Experimental Unit Performance)

*Andrew Tong, The Ohio State University and
Dr. Ronald Breault, National Energy Technology Laboratory,
U.S. Department of Energy*

17. GE (Alstom) Limestone-based Chemical Looping Update

*John Marion, Armand Levasseur, and Fred Vitse, GE – Alstom Power Inc.; and
Steve Richardson, U.S. Department of Energy, National Energy Technology
Laboratory, USA.....1*

32. Flow Conditions on the Chemical Looping Combustion Fluidized Bed Facility

*Krzysztof Kulicki, Tomasz Czakiert, Anna Żyłka, Sylwia Jankowska,
Czestochowa University of Technology - Institute of Advanced Energy
Technologies; Jarosław Krzywański, Jan Długosz University in Czestochowa,
Faculty Of Mathematics And Natural Science and Wojciech Nowak, AGH
University of Science and Technology in Krakow, Faculty of Energy and Fuels,
POLAND.....2*

37. CFD Modeling of the Fuel Reactor in NETL's 50 kw Chemical Looping Facility

*Ronald W. Breault, Justin Weber, and Doug Straub, National Energy
Technology Laboratory, U.S. Department of Energy; and Sam Bayham, ORISE,
USA.....14*

68. Chemical Looping with Oxygen Uncoupling Using a Copper-based Solid Oxygen Carrier

*Andrew Fry, Kevin Whitty and JoAnn Lighty, Department of Chemical
Engineering and Institute for Clean and Secure Energy, University of Utah,
USA.....15*

71. The Syngas Chemical Looping and Coal Direct Chemical Looping Processes: Pilot-Scale Test Unit Development and Operation

*Tien-Lin Hsieh, Cheng Chung, Dikai Xu, Andrew Tong, Mandar Kathe, Dawei
Wang, Pengfei He, Sourabh Nadgouda, Yitao Zhang, Mengqing Guo, and Liang-
Shih Fan, The Ohio State University, USA.....17*

Chemical Looping II (Carrier Development and Evaluation)

*Hanjing Tian, West Virginia University and
Dr. Ronald Breault, National Energy Technology Laboratory,
U.S. Department of Energy*

- 19. The Fate of Fuel Bound Nitrogen in a Solid Fuel Chemical Looping Combustion Process Over Oxygen Carriers of Ilmenite and Fe_2O_3 Supported on $Mg-ZrO_2$**
Dongmei Zhao, Martin Ostergren, and Henrik Leion, Department of Chemistry and Chemical Engineering, and Fredrik Normann, Department of Energy and Environment, Chalmers University, SWEDEN.....19
- 29. Evaluating the Effect of Inert Supports and Alkali Metal on the Performance of Red Mud Oxygen Carrier in Chemical Looping Combustion**
Jinhua Bao, Liangyong Chen, Fang Liu, Heather Nikolic, Zhen Fan and Kunlei Liu, Center for Applied Energy Research, University of Kentucky, USA.....28
- 45. Study of Char Gasification in Mineral Oxygen Carriers**
Ewa Marek, and Stuart, Scott, Department of Engineering, University of Cambridge, UNITED KINGDOM.....29
- 48. Effect of Steam on Hematite Reduction in a Cyclic Fluidized Bed Chemical Looping System**
Ronald W. Breault, and Justin Weber, National Energy Technology Laboratory; and Sam Bayham and Michael Bobek, ORISE, USA.....40
- 89. Moving Bed Chemical Looping Combustion Reference Plant Design and Sensitivity Studies**
Robert Stevens, National Energy Technology Laboratory, U.S. Department of Energy; and Richard Newby and Dale Keairns, Booz Allen Hamilton, Inc., USA.....41

Chemical Looping III (Systems Analysis and Component Development)

Dr. Ronald Breault, National Energy Technology Laboratory, U.S. Department of Energy

- 54. Co-production of Power and Hydrogen by Combined Processes of Chemical Looping, Combustion, and Methane Decomposition/Reforming**
Hanjing Tian, U.S. Department of Energy, National Energy Technology Laboratory; and Ranjani Siriwardane, Department of Chemical Engineering, West Virginia University, USA.....42
- 72. Coal to Methanol Process Using Chemical Looping Gasification for Syngas Production and in Situ CO_2 Capture**
Mandar Kathe, Andrew Tong, Tien-Lin Hsieh, Elena Blair, Abbey Empfield, and Liang-Shih Fan, The Ohio State University; James Simpson, WarleyParsons; and Robert Statnick, Clear Skies LLC, USA.....43
- 69. Increased Oxygen Delivery in Chemical Looping Combustion with Oxygen**

Uncoupling

Andrew Fry, Kevin Whitty, and JoAnn Lighty, Department of Chemical Engineering and Institute for Clean and Secure Energy, University of Utah; and Bradley Damstedt and Larry Bool, Praxair, USA.....44

90. Design Update of a Solid Fuel Fluidized Bed Reactor for Chemical Looping Combustion Studies

J.S. Hoffman, J.M. Weber, R.W. Breault, National Energy Technology Laboratory, U.S. Department of Energy, USA.....46

Chemical Looping IV

Dr. Ronald Breault, National Energy Technology Laboratory, U.S. Department of Energy

80. The Fabrication of Supported Metals Over Zirconia and Ceria Modified Alumina Prepared by Core-shell Technique Used as an Oxygen Carrier for the Clean Canadian Coal Combustion

Mohammad Hashem Sedghkerdar, Amir H. Soleimansalim, Davood Karami, Nader Mahinpey, the University of Calgary, Calgary, AB, CANADA.....49

81. The Synthesis of the Substituted Ni, Fe-based Perovskites Using Pechini and Modified Pechini Methods for the Chemical Looping of Canadian Coals

Amir H. Soleimansalim, Mohammad Hashem Sedghkerdar, Negar Manafi Rasi, Davood Karami, Nader Mahinpey Department of Chemical and Petroleum Engineering, Schulich School of Engineering, the University of Calgary, Calgary, CANADA.....50

99. Development of a Carbon Stripper Particle Separation System for Chemical Looping Applications

Ronald Breault, National Energy Technology Laboratory, U. S. Department of Energy; and Steven Rowan, Richard Stehle, and Michael Bobek, Oak Ridge Institute for Science and Education, USA.....52

Biomass Cofiring

Les Marshall, Ontario Power Generation

91. Hydrogen From Biomass Gasification Using Calcium Looping

Kiran Raj Burra and Ashwani K. Gupta, The Combustion Laboratory, Department of Mechanical Engineering, University of Maryland, USA.....55

64. Combustion Behaviors of a Herbaceous and a Woody Biomass

Aidin Panahi, and Yiannis A. Levendis, Mechanical and Industrial Engineering, Northeastern University , USA; and and Nikita Vorobiev, Martin Schiemann, and Viktor Scherer, Ruhr University Bochum, GERMANY.....62

84. EDF's Biomass Business and Progress with Torrefaction
Mathieu Insa. EDF, FRANCE.....73

25. Capture of Harmful Gaseous KCl with Coal Fly Ash under Conditions Typical for Fluidized Beds
Patrik Yrjas, Daniel Lindén, Christoffer Sevonius and Leena Hupa, Johan Gadolin Process Chemistry Centre, Abo Akademi University, FINLAND.....74

93. Development and Testing of the Next-Gen. Slagging Prediction Tool for Large Scale pf Boilers Fired with Various Quality Solid Fuels
Piotr Plaza, Selahattin Babat, and Jörg Maier, Institute of Combustion and Power Plant Technology – IFK, Stuttgart University, GERMANY.....85

Gasification Technologies

Massood Ramezan, Leonardo Technologies

30. Testing of Advanced Vanadium Membranes for Hydrogen and CO₂ Separation on Coal-Derived Syngas
Joshua J. Stanislawski, Tyler J. Curran, and Scott G. Tolbert, Energy & Environmental Research Center University of North Dakota, USA; and Dr. Daniel Roberts, and Dr. Michael Dolan, CSIRO, AUSTRALIA.....87

31. Gasifier Consideration for Advanced Power Cycles
Joshua J. Stanislawski, and Jason D. Laumb, Energy & Environmental Research Center University of North Dakota; and Xijia Lu, and Mike McGroddy, 8 Rivers, USA.....88

51. Advanced Concepts in Modular Coal and Biomass Gasifiers
John P. Dooher, Adelphi University/Dooher Institute of Physics and Energy (Ying of Balquhain Fellow); Marco J. Castaldi, Chemical Engineering Department, The City College of New York, City University of New York; and Dean Modroukas, Innoveering, USA.....90

Modeling

Dr. Edmundo Vasquez, Clyde Bergemann Power Group Americas Inc.

1. Integrating Renewable Hydrogen into a Coal-to-Liquids Plant: Steady State Design and Dynamic Simulation
Matthias Gootz, Bernd Meyer IEC, TU Bergakademie Freiberg, GERMANY.....102

- 12. Assessing the Roles of Different Sub-Models in CFD Simulations of Oxy-Combustion of Coal and Biomass Blends**
Gautham Krishnamoorthy, Department of Chemical Engineering, University of North Dakota; and Muhammad Sami, ANSYS, USA.....104
- 18. Physical Properties of Low Rank Coal in Superheated Steam Drying Process**
Qiulin Wang, Zhiping Jin and Tao Bai, School of Power Engineering, Shanxi University, CHINA.....125
- 41. HITEMP2010 Based SLW Radiation Model Development and Application to High Pressure, Fuel Rich Simulations**
Jiefu Ma, Air Liquide, Delaware Research and Technology Center, USA.....126
- 98. Thermal Energy Storage - Project SHIP. Overview and Status**
Wójs K., Lichota J., Gnutek Z., Kaczmar J., Pietrowicz S., Plutecki Z., Tomczuk K., Naplocha K., Rączka P., Smykowski D., Sitka A., Redzicki R., Szulc P., Tietze T., Rogula J., Kolasiński P., Wróblewski R., Jodkowski J., Dmitruk A., Podkomorzy P., Wrocław University of Technology, POLAND.....128

Advanced Beneficiation I

*Dr. Dave Osborne, Somerset International Australia Pty Ltd,
Australia*

- 4. Experimental Research on Flocculation of the Cyanide Tailing Suspensions**
Ya Liu, Shufeng Ye, and Yunfa Chen, State Key Laboratory of Multiphase Complex Systems, Institute of Process Engineering, Chinese Academy of Sciences, CHINA.....136
- 55. Advanced Beneficiation Studies for 660 MWe New Construction and 550 MWe Retrofit Using Indonesian Coal**
Una Nowling, Black & Veatch Corporation; and Sandra Broekema, Great River Energy, USA.....143
- 56. Creating Value in the Coal Delivery Chain via Advanced Beneficiation Approaches**
*Dr. Dave Osborne, Somerset International Australia Pty Ltd,
AUSTRALIA.....153*
- 58. Water in Coal and its Influence on Attrition during Drying**
David Stokie and Sankar Bhattacharya, Department of Chemical Engineering, Monash University, AUSTRALIA163
- 105. Rare Earth Opportunities for Coal**
Gerald H. Luttrell, Michael J. Kiser, Roe-Hoan Yoon, Department of Mining & Minerals Engineering, and C. Aaron Noble, Department of Mining Engineering, Virginia Polytechnic Institute & State University; and Abhijit Bhagavatula,

Mohammad Rezaee, and Rick Q. Honaker, Mining Engineering Department,
University of Kentucky, USA.....174

Advanced Beneficiation II

Dr. Dave Osborne, Somerset International Australia Pty Ltd.,
Australia

60. Rapid Beneficiation of Coal Tailings to Produce a High Calorific Value Product

Kim van Netten and Kevin P. Galvin, Centre for Advanced Particle Processing
and Transport, Newcastle Institute for Energy and Resources, University of
Newcastle, AUSTRALIA.....175

86. Coal Micro-Pricing: A Market Driven Perspective on Coal Production

Gerald H. Luttrell, Department of Mining & Minerals Engineering, Virginia
Polytechnic Institute & State University; and C. Aaron Noble, Department of
Mining Engineering, West Virginia University, USA.....176

87. Dry Beneficiation for Improved Plant Performance

Jan Verboomen, Australian Inspection Technologies, AUSTRALIA.....177

88. Characterization of Coal before and after Dry Beneficiation

Nisarg Tripathi, Deepak Pudasainee, Ebrahim Azimi, Rajender Gupta,
Department of Chemical and Materials Engineering, University of Alberta,
Edmonton, CANADA.....187

109. Premium Coal Fuels with Advanced Coal Beneficiation

Louis J. Wiberly, CSIRO Energy Technology; and Dr. David Osborne, Somerset
International, AUSTRALIA.....188

Biomass Utilization

Dr. Edmundo Vasquez, Clyde Bergemann Power Group Americas Inc.
and Dr. Ashwani Gupta, University of Maryland

66. Heat Transfer Conditions in a Rotary Kiln Test Furnace Using Coal, Biomass and Co-firing Burners

Adrian Gunnarsson, Robert Johansson, and Klas Andersson, Chalmers University
of Technology; and Christian Fredriksson, LKAB, SWEDEN.....197

75. Computational study on Co-Ring of Biomass with Coal in an Industrial Scale Furnace: Effect of Biomass/Coal Ratio on the Wall Heat Flux Distribution

J. Mondoux, M. Patel, Department of Chemical and Materials Engineering,
University of Alberta; and P. Nikrityuk, and R. Gupta, Capital Power
Corporation, CANADA.....208

83. Thermochemical Biomass Char Conversion: Study on Pyrolysis and Gasification Kinetics

Christoph Schneider, Philipp Stoesser, Sonia Rincon, and Thomas Kolb, Karlsruhe Institute of Technology (KIT), Engler-Bunte-Institute Division Fuel Technology, GERMANY.....210

62. A Correlation for Flame Length of Oxygen-Assisted, Swirled, Coal and Biomass Flames

David Ashworth, John Tobiasson, Bhupesh Dhungel, and Dale R. Tree, Brigham Young University, USA.....220

63. Determining H₂O Concentration Using Spectral Band Emissions

John Tobiasson, David Ashworth, Bhupesh Dhungel, and Dale R. Tree, Brigham Young University, USA.....231

Advanced Energy Conversion Systems

Massood Ramezan, Leonardo Technologies

5. Laboratory Studies on Cavity Formation and Product Compositions During Gasification of Subbituminous Coal in Underground Coal Gasification (UCG) Reactor

M.M. Khan, Q. Liu and R. Gupta and J. Trivedi, University of Alberta, CANADA.....242

3. The Application of Refractory Waste for the Anti-oxidation of the Steel

GuoYan Fu, State Key Laboratory of Multiphase Complex Systems, Institute of Process Engineering, Chinese Academy of Sciences; and ShuFeng Ye, YunFa Chen, State Key Laboratory of Multiphase Complex Systems, Institute of Process Engineering, Chinese Academy of Sciences, CHINA.....244

28. Efficient Reactivation of Fluidized Bed Combustor Ashes: A Simplified Procedure

Olev Trass, Department of Chemical Engineering and Applied Chemistry, University of Toronto, CANADA.....252

9. Experimental Rig for Gathering Kinetic Data of Reacting Particles under MILD Combustion

W.P. Adamczyk, R.A. Bialecki, A. Klimanek, A. Szlek, G. Wecel, A. Katelbach-Wozniak, and S. Sladek, Institute of Thermal Technology, Silesian University of Technology, POLAND; and M. Ditaranto, N. Erland and L. Haugen, SINTEF Energi A.S., NORWAY.....264

Environmental Regulation Impacts

Byron Burrows, TECO

95. An Alternative Approach – Proven, Reliable and Cost Effective – in Eliminating the Waste Water Stream from Power Plants

	<i>Robert Nicolo, Environmental Product Director, Mitsubishi Hitachi Power Systems Americas, Inc., USA.....</i>	<i>267</i>
96. Impacts of Coal Combustion Residual and Effluent Limitation Guideline Rules	<i>Catherine Magliocco, Randy, Melton, David Lukcic and Amy Butler, TECO, USA.....</i>	<i>268</i>
97. Characterization of Free Water and Entrained Water and Evaluation of Wastewater Treatment/Discharge Requirements for Coal Combustion Residual Pond Closure	<i>Michelle Mayfield, AECOM, USA.....</i>	<i>N/A</i>
11. Advantages of Using Magnesium Hydroxide for SO₃ Abatement	<i>Kent W. Schulz, and Douglas C. Gagnon, Fuel Tech, Inc., USA.....</i>	<i>273</i>
104. Emerging Water Management Challenges at Coal-Fired Power Stations using Flue Gas Desulfurization - Requirements to Address New USEPA Regulations	<i>Chris Hertle, Brett Goebel, PhD, Rosemary Niechcial, P.Eng., Michael Condran, PE, and Tom Emenhiser, GHD Services Inc., USA and Australia.....</i>	<i>274</i>
 Innovative Applications to Solve Problems		
<i>Chris Smyrniotis, Fuel Tech, and Halina Pawlak-Kruczek, Wrocław University of Technology, Poland</i>		
8. The Pyrolysis Behaviour of Solvent Extracted Metaplast Material from Heated Coal Using LDI-TOF Mass Spectroscopy Measurements	<i>Rohan Stanger, Quang Ahn Tran, Tariq Attalla, Nathan Smith, Terry Wall, Department of Chemical Engineering, University of Newcastle, and Analytical and Biomolecular Research Facility, University of Newcastle, AUSTRALIA.....</i>	<i>275</i>
57. Leadership Roles by Academics in Biomethane Energy Projects	<i>Maria RH Takeuchi, Tatsuya Hasegawa, and Keiichi N. Ishihara, Institute of Materials and Systems for Sustainability, Nagoya University, JAPAN.....</i>	<i>276</i>
74. Study of Bituminous Coal and Lignite Blends Pyrolysis by Thermogravimetric Method and in Tube Furnace	<i>Halina Pawlak-Kruczek, Jacek Zgóra, Krystian Krochmalny, and Robert Lewtak, Institute of Power Engineering, Wrocław University of Technology, POLAND.....</i>	<i>287</i>
102. Low/Zero Cost Blue Plume & Cold End Corrosion Control	<i>Doug Gagnon, Fuel Tech, Inc., USA.....</i>	<i>302</i>

106. Non-thermal Plasma Process For Reduction CO₂, SO₂ & NO_x Gases From Coal Power Plants

Michael Garvin, Illinois Institute of Technology, USA.....303

Oxyfuel Technologies I

Prof. Klas Andersson, Chalmers University, Sweden, and

Prof. Andrew Fry, University of Utah

7. Mercury and SO₃ Measurements on the Fabric Filter at the Callide Oxy-fuel Project during Air and Oxy-fuel Firing Transitions

Rohan Stanger, Lawrence Belo, Timothy Ting, and Terry Wall, Chemical Engineering, University of Newcastle; Chris Spero, Callide Oxyfuel Project, CS Energy Ltd./Callide Oxyfuel Services Pty Ltd., AUSTRALIA.....306

27. Oxygen Concentration in Oxy-fuel Combustion

Yiannis A. Levendis and Reza Khatami, Mechanical and Industrial Engineering, Northeastern University, USA.....307

20. A Method of Retrieving Char Oxidation Kinetic Data from Reacting Particle Trajectories in a Novel Test Facility under Oxy Combustion Conditions

W. Adamczyk, R.A. Białeccki, A. Katelbach-Woźniak, A. Klimanek, S. Śladek, A. Szlęk, G. Węcel, Institute of Thermal Technology, Silesian University of Technology, POLAND.....317

53. Density, Porosity, and Heat Capacity Characteristics of Ash Deposits from a 1.5 MW Coal Furnace

Lauren Koczynski, Teri Draper, Terry Ring and Eric Eddings, Department of Chemical Engineering and Institute for Clean and Secure Energy, University of Utah, USA.....325

70. Heat Transfer and Temperature Behavior of a Maximum O₂ Concentration Oxy-Coal Flame

Andrew Fry, Kaitlyn Scheib, Yueming Wang, and Jost Wendt, Department of Chemical Engineering and Institute for Clean and Secure Energy, University of Utah; and Andrew Chiodo, and Kevin Davis, Reaction Engineering International, USA.....326

Oxyfuel Technologies II

Prof. Klas Andersson, Chalmers University, Sweden, and

Prof. Andrew Fry, University of Utah

67. Pilot-Scale Investigation and Modeling of Heat Flux and Radiation from an Oxy-

coal Flame

Andrew Fry, Oscar Diaz, Jennifer Spinti, and Eric Eddings, Department of Chemical Engineering and Institute for Clean and Secure Energy, University of Utah, USA.....328

85. **Approximations for Particle Scattering Phase Functions in Solid Fuel Combustion**

Tim Gronarz, and Reinhold Kneer, RWTH Aachen, Institute of Heat and Mass Transfer, GERMANY.....330

52. **Thermal Characterization of a 1.5 MW Pulverized-coal Furnace Using Infrared Heat Flux, Total Heat Flux and Measured Heat Loss**

Teri Draper, Andrew Fry, Lauren Koczyński, Terry Ring and Eric Eddings, Department of Chemical Engineering and Institute for Clean and Secure Energy, University of Utah, USA.....339

Oxyfuel Technologies III

Prof. Klas Andersson, Chalmers University, Sweden, and Prof. Andrew Fry, University of Utah

76. **Simulation and Validation of 15 Mwth Oxy-Coal Power Boiler**

Benjamin J. Isaac, Jeremy N. Thornock, Sean T. Smith, and Philip J. Smith, Institute for Clean and Secure Energy, University of Utah, USA.....340

77. **Characterizing the Impacts of High Temperatures in Oxy-Coal Combustion Systems**

Kevin Davis, Zhonghua Zhan, Dave Wang, Martin Denison, and Andrew Chiodo Reaction Engineering International; Andrew Fry, and Jost Wendt Department of Chemical Engineering and Institute for Clean and Secure Energy, University of Utah; and Mark Schoenfeld, Jupiter Oxygen, USA.....341

78. **Uncertainty Quantification for Coarse-Grained Modeling of Coal Devolatilization**

Sean T. Smith, Benjamin Schroeder, and Salvatore Iavarone, Institute for Clean and Secure Energy, University of Utah, USA.....342

79. **Towards Next Generation Simulations of Full-Scale Coal-Fired Boilers**

Jeremy Thornock, Ben Isaac, Sean Smith, Oscar Diaz-Ibarra, and Philip Smith, Institute for Clean and Secure Energy, University of Utah, USA.....343

Combustion Technologies & Issues

Alan Paschedag, Covanta, and J.J. Letcavits, AEP

2. **Arsenic Emissions and Speciations in High Temperature Treatment of a Typical High Arsenic Coal**

Chong Tian, Junying Zhang, and Chuguang Zheng, State Key Laboratory of Coal Combustion, Huazhong University of Science and Technology, CHINA; and Rajender Gupta, Department of Chemical and Material Engineering, University of Alberta, CANADA.....344

13. Challenges for Coal Based Electricity Generation in Energy Systems with High Capacity of Variable Renewable Energy Sources

Stefania Osk Gardarsdottir, Fredrik Normann, and Filip Johnson, Department of Energy and Environment, Chalmers University of Technology, SWEDEN.....345

44. Combustion and Emission Characteristics of HTC-Coals in Pulverized Fuel Combustion Test Rig

Manoj Paneru, Zhang Qing, Jörg Maier, and Günter Scheffknecht, Institute of Combustion and Power Plant Technology, GERMANY.....357

40. Effect of CO₂-Enriched Air on Boiler Performance

Prasanna Seshadri and Hamid Farzan, The Babcock & Wilcox Company; Tim Merkel and Xiaotong Wei, Membrane Technology Research Inc.; and José D. Figueroa, U.S. DOE National Energy Technology Laboratory, USA.....359

50. Comparison of Ash Propensity Predicted by Indices with Actual Ash Deposition Behaviour

Anthony Williams PhD BE, Bob Creelman PhD BSc, and Terry Dixon PhD BSc., A&B Mylec Pty Ltd., AUSTRALIA.....371

Value-in-Use and Power Plant Modeling

Dr. Dr. Edmundo Vasquez, Clyde Bergemann Power Group Americas Inc.

14. Effect of Coal Beneficiation on Efficiency of Advanced PCC Power Plants

Nenad Sarunac University of North Carolina at Charlotte; and Charles Bullinger and Mark Ness Great River Energy, Coal Creek Station, USA.....373

49. Supply Chain Optimisation with Beneficiation Is the Key to Minimising Generation Costs

Anthony Williams, A&B Mylec; and James Graham, Somerset International, AUSTRALIA.....375

46. Optimization of Efficiency, Stability and Operability of Power Plant Using a Model-based Approach

Chen Chen and George M. Bollas, Department of Chemical & Biomolecular Engineering, University of Connecticut, USA.....387

Carbon Capture Utilization Transport and Storage I

Dr. Erik Meuleman, ION Engineering

26. Development of a CO₂ Specification for a CCS Hub Network – The Implications for CO₂ Capture Projects for Clean Coal Technologies

Trent Harkin, and Ian Filby, The CarbonNet Project; and Heidi Sick, Dan Manderson, and Rebecca Ashton, Victorian Government Department of Economic Development, Jobs, Transport and Resources, AUSTRALIA.....389

22. Preparation of Adsorbent from Fly Ash for CO₂ Capture

Dang Viet Quang, Abdallah Dindi, and Mohammad R.M. Abu Zahra, The Institute Center for Energy (iEnergy), Masdar Institute of Science and Technology, UNITED ARAB EMIRATES.....401

33. Steam Extraction Configuration for CO₂ Removal with Amines

Zhen Fan, and Kunlei Liu, Centre for Applied Energy Research, University of Kentucky, USA.....410

Carbon Capture Utilization Transport and Storage II

Dr. Brian North, CSIR Materials Science and Manufacturing (Energy Materials), South Africa

24. Electrochemical Conversion of CO₂ to Chemicals

Madhivanan Muthuvel, Fei Lu, and Gerardine G. Botte, Center for Electrochemical Engineering Research, Department of Chemical and Biomolecular Engineering, Russ College of Engineering and Technology, Ohio University, USA.....418

101. Novel Advanced Solvent-Based Carbon Capture Pilot Demonstration

Erik E.B. Meuleman, Nathan R. Brown, Grayson W. Heller, Tyler R. Silverman, Greg A. Staab, and Alfred E. Brown, ION Engineering, USA.....419

107. CO₂ Transformation to Carbon Nanofibers by Molten Carbonate Electrolysis

Prof. Stuart Licht, George Washington University, USA.....420

Energy From Waste

Alan Paschedag, Covanta

10. Discrete Element Modeling of MSW Incineration on Grate Firing Systems: Influence of Waste Properties

Frank Wissing, Siegmund Wirtz, and Viktor Scherer, Department of Energy Plant Technology, Ruhr University Bochum, GERMANY.....421

59. Advanced Tools for Troubleshooting and Optimization of Fire-side Performance and Emissions in WTE

Hong-Shig Shim, Dave Wang, Martin Denison, and Kevin A. Davis, Reaction Engineering International, USA431

Improvements for Existing Power Plants: Options and Plans for Compliance with CAA Regulations

Mark Ness, Great River Energy

23. Low Temperature Drying Process Improves Heat Rate and Water Balance for Power Plants

Ye Yao, Mark Ness, P.E., Charles Bullinger, P.E. Great River Energy; and Dr. Edward K. Levy and Xingchao Wang, Lehigh University; and Dr. Nenard Sarunac, University of North Carolina, USA.....433

42. Integration and Balance-of-the-Plant Impact of Zero Liquid Discharge Technologies for Wet FGD Wastewater

Gosia Stein-Brzozowska, Muhammad Majid, Jörn Schuler, Torsten Buddenberg, Bernd Vollmer, Dr. Christian Bergins, and Prof. Emmanouil Kakaras, Mitsubishi Hitachi Power Systems Europe GmbH, GERMANY; and Dr. Song Wu, and Robert Nicolo, Mitsubishi Hitachi Power Systems Americas, Inc., USA.....441

47. Effects of Combined Heat and Power on Coal Plant Carbon intensity

Mark Ness, P.E., Ye Yao, Charles Bullinger, P.E. and Mark Strohfus, Great River Energy, USA.....453

Water/Energy Nexus

Josh Stanislawski, Energy & Environmental Research Center

16. Pilot-scale Study of a Waste Heat and Water Recovery Technology for Coal Power Plant Flue Gas

Dexin Wang, Ainan Bao, and Walter Kunc, Gas Technology Institute; and Heyang Wang and Zhanhua Ma, SmartBurn LLC, USA.....463

108. Desalination of Brines Associated with Geological Storage of Carbon Dioxide

Jinesh Jain Ph.D., AECOM, National Energy Technology Laboratory, U.S. Department of Energy, USA.....N/A

110. Water and Energy Sustainability Technology Testing

Joshua J. Stanislawski and Christopher L. Martin, Energy & Environmental Research Center, University of North Dakota, USA.....473

21. Heat and Water Recovery in Coal-fired Power Industry

Yingying Xiong, Zhiping Jin, Dongxiong Li, and Tao Bai, Power Engineering, Shanxi University, CHINA.....474

Economic Optimization Factors in Power Production

J. J. Letcavits, AEP

92. Design of Advanced Ultra-supercritical Component Test Facility with 760°C Superheater and Steam Turbine

Horst Hack, Electric Power Research Institute; Vito Cedro, III, National Energy Technology Laboratory; Robert Purgert, Energy Industries of Ohio; Paul Weitzel, The Babcock & Wilcox Company; James Pschirer, GE Power; and Christine Zemsky, GE Power, USA.....475

34. The Sensitivity of Cost of Electricity to Site-Specific Factors

Wm. Morgan Summers, U.S. Department of Energy, National Energy Technology Laboratory; Vincent Chou, Marc Turner, and Mark Woods, Booz Allen Hamilton, Inc.; and Lora Pinkerton, WorleyParsons Group, USA.....486

103. Reducing a Coal Plant's Operating Cost by Reducing its SCR's MOT

Doug Gagnon, Fuel Tech, Inc., USA.....487