

# **Advances in Fossil Energy R&D 2015**

Topical Conference at the 2015 AIChE Annual Meeting

Salt Lake City, Utah, USA  
8-13 November 2015

ISBN: 978-1-5108-1850-7

**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© (2015) by AIChE  
All rights reserved.

Printed by Curran Associates, Inc. (2016)

For permission requests, please contact AIChE  
at the address below.

AIChE  
120 Wall Street, FL 23  
New York, NY 10005-4020

Phone: (800) 242-4363  
Fax: (203) 775-5177

[www.aiche.org](http://www.aiche.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

<b>(38a) Optimization Models and Algorithms for Water Supply Chain Network Design and Operations in Shale Gas Production</b> .....	1
<i>Jiyao Gao, Fengqi You</i>	
<b>(38b) Metrics Driven Systems Analysis for Water &amp; Energy Sustainability</b> .....	2
<i>Arunprakash T. Karunanithi, Jonathan Dubinsky</i>	
<b>(38c) An Industrial Ecology Approach for Managing Wastewater from Shale Gas Production</b> .....	3
<i>Sakineh Tavakkoli, Radisav D. Vidic, Vikas Khanna</i>	
<b>(38d) Integrated Optimization of Water Supply Systems Scheduling for Energy Efficient Operations</b> .....	4
<i>Hanyu Shi, Fengqi You</i>	
<b>(38e) Optimization of Complex Integrated Water and Membrane Network Systems</b> .....	5
<i>Musah Abass</i>	
<b>(38f) An MINLP Model for the Water Management in Shale Gas Operations</b> .....	13
<i>Luis Fernando Lira-Barragán, José María Ponce-Ortega, Meadardo Serna-González, Mahmoud M. El-Halwagi</i>	
<b>(58a) Ionic Liquid Composite Membranes for CO<sub>2</sub>/Light Gas Separations</b> .....	14
<i>Richard D. Noble, Douglas L. Gin, Matthew G. Cowan, Zoban Singh</i>	
<b>(58b) Scale-up of Amine-Containing Membranes for CO<sub>2</sub> Capture and Separation</b> .....	15
<i>Witopo Salim, Varun Vakharia, Dongzhu Wu, Yuanxin Chen, Lin Zhao, Yang Han, W. S. Winston Ho</i>	
<b>(58c) Microencapsulation of Advanced and Novel CO<sub>2</sub> Sorbents</b> .....	16
<i>John Vericella</i>	
<b>(58d) Novel Membrane Absorption-Based Processes for CO<sub>2</sub> Capture</b> .....	17
<i>Kamalesh K. Sirkar, John Chau, Xingming Jie, Tripura Mulukutla</i>	
<b>(58e) The Influence of Water on Polymer/Silica Hollow Fiber Sorbents for CO<sub>2</sub>/N<sub>2</sub> Sorption</b> .....	18
<i>Ying Labreche, Steven K. Burgess, Ryan Lively, Christopher W. Jones, William J. Koros</i>	
<b>(58f) CO<sub>2</sub> Capture from Flue Gas By PSA: Bench Scale Demonstration of a Novel Structured Adsorbent</b> .....	19
<i>James A. Ritter, Atikur Rahman, Marjorie A. Nicholson, Nima Mohammadi, Mohammad I. Hossain, Lutfi Erden, Armin D. Ebner</i>	
<b>(58g) Staged Membrane Configurations for CO<sub>2</sub> Capture</b> .....	20
<i>Norfamila Che Mat, Glenn Lipscomb</i>	
<b>(62a) Is Social and Academic Interest in Carbon Capture and Storage Declining?</b> .....	21
<i>Faezeh Karimi, Rajab Khalilpour</i>	
<b>(62c) Reductive Calcination: Process Integration in Mineral Processing</b> .....	22
<i>Georg Baldauf-Sommerbauer, Susanne Lux, Mathäus Siebenhofer</i>	
<b>(62d) Enzyme Based Strategy for Energy Efficient Carbon Capture and Storage</b> .....	23
<i>Shunxiang Xia, Ping Wang</i>	
<b>(62e) Geological Labs on Chip (GLoCs): New Tools for Investigating Key Aspects of CO<sub>2</sub> Geological Storage</b> .....	33
<i>Sandy Morais, Abdou Diouf, Carole Lecoutre, Yves Garrabos, Dominique Bernard, Samuel Marre</i>	
<b>(62g) Thermal Decomposition of Methane Hydrates Combined with Carbon Dioxide Sequestration</b> .....	34
<i>Swanand Tupsakhare, Marco Castaldi</i>	
<b>(98a) Water Desalination By Shock Electrodialysis</b> .....	35
<i>Nancy Lu</i>	
<b>(98b) Exergy Analysis of a Power Plant in Abu Dhabi (UAE)</b> .....	36
<i>Abdullah Alhosani</i>	
<b>(98c) Insights into the Hydrothermal Stability of ZSM-5 Under Relevant Biomass Conversion Reaction Conditions</b> .....	37
<i>David W. Gardner</i>	
<b>(98d) Effects of Season and Heating Mode on Ignition and Burning Behavior of Ten Species of LIVE FUEL Measured in a FLAT-Flame Burner System</b> .....	38
<i>Samantha Smith</i>	
<b>(98e) Characterization and Particle Sizing of the Composition of E-Cigarette Aerosol</b> .....	47
<i>Jordan Berger</i>	
<b>(98f) Ammonia Removal from Aquaculture Stocking Water</b> .....	48
<i>C. Martin</i>	
<b>(98g) Impact of Chemical Dopants and Passivation Schemes on Carbon Nanotube Sheet Conductivity</b> .....	49
<i>Colleen C. Lawlor</i>	
<b>(98h) Îæfilms: Dynamics of Thin-Films Under Physiological Fluids and Shear Flow</b> .....	50
<i>Monica Torralba</i>	
<b>(98i) Photocatalytic Methanol Reforming on TiO<sub>2</sub></b> .....	51
<i>Katelyn Dagnall</i>	
<b>(98j) Room Temperature Shape Memory Polymers</b> .....	52
<i>Heather Fairbairn</i>	
<b>(125a) Lessons Learned from the Secarb Integrated CO<sub>2</sub> Capture and Storage Project</b> .....	53
<i>Gerald Hill, Kimberly Sams, Jerrad Thomas, Richard Esposito</i>	
<b>(125b) New Advanced Aqueous Amine Solvents for CO<sub>2</sub> Capture</b> .....	54
<i>Jason E. Bara, David A. Wallace, Max Mittenhal</i>	
<b>(125c) Aminosilicone Carbon Capture Process Development</b> .....	55
<i>Tiffany Westendorf, Benjamin Wood, Irina Spiry</i>	

<b>(125d) Anti-Foaming Study for Physical Solvents for Pre-Combustion CO<sub>2</sub> Capture</b> .....	56
<i>Fan Shi, Jeffrey Culp, Nicholas Siefert, David Hopkinson</i>	
<b>(125e) Molecular Modeling of Non-Aqueous CO<sub>2</sub> Capture Solvents</b> .....	57
<i>David C. Cantu, Deepika Malhotra, Phillip K. Koeh, David J. Heldebrant, Roger Rousseau, Vassiliki-Alexandra Glezakou</i>	
<b>(125f) Regulatory Process Control of an Advanced Post-Combustion Amine Scrubbing System</b> .....	58
<i>Matthew S. Walters, Thomas F. Edgar, Gary T. Rochelle</i>	
<b>(125g) Dynamics of Absorption of CO<sub>2</sub> into Sprayed Solvents</b> .....	61
<i>Yash Tamhankar, Brett King, James R. Whiteley, Tony Cai, Ken C. McCarley, Mike Resetarits, Clint P. Aichele</i>	
<b>(181b) Integrated Market and Engineering Modelling and Optimization of Low-Carbon Electricity Generation</b> .....	62
<i>Niall Mac Dowell, Iain Staffell</i>	
<b>(181c) Upscaling a Devolatilization Model for Oxy-Combustion Simulations Using Validation and Uncertainty Quantification</b> .....	63
<i>Sean T. Smith</i>	
<b>(181d) Thermodynamic Modeling of MEA-Based CO<sub>2</sub> Capture Process with Uncertainty Quantification and Validation with Steady-State Data from a Pilot Plant</b> .....	64
<i>Joshua Morgan, Anderson Soares Chinen, Benjamin Omell, Debangsu Bhattacharyya, Charles Tong, David C. Miller, John Wheelton, Bill Buschle, Mathieu Lucquiani</i>	
<b>(181e) A Reduced-Order Building Approach to Simulation-Based Optimization of Complex Energy Systems</b> .....	65
<i>Zachary Wilson, Alison Cozad, Zhihong Yuan, Nick Sahinidis, David C. Miller</i>	
<b>(181f) Optimization Under Uncertainty with Rigorous Process Models</b> .....	66
<i>John C. Eslick, Charles Tong, Brenda Ng, Andrew Lee, Alexander W. Dowling, David S. Mebane, Yang Chen, David C. Miller</i>	
<b>(266a) Dynamic Modeling of Steam Thermal Power Plants for Real-Time Optimization</b> .....	67
<i>Chen Chen, Kyle D. Such, Zhiqian Zhou, Xinsheng Lou, Shizhong Yang, Olutoye Akinjiola, Carl Neuschaefer, George M. Bollas</i>	
<b>(266b) Potential for Solid-Oxide Fuel Cell Technologies to Minimize Water Use in the Electric Power Sector</b> .....	69
<i>Erik Shuster</i>	
<b>(266c) Simulation and Validation of 15 Mwth Oxy-Coal Power Boiler</b> .....	71
<i>Benjamin Isaac, Jeremy Thornock, Sean T. Smith, Philip Smith</i>	
<b>(266d) Development and Deployment of a Large Eddy Simulation Code for Simulating Full-Scale, Coal-Fired Boilers</b> .....	72
<i>Jeremy N. Thornock, Benjamin Isaac, Sean T. Smith, Oscar Diaz-Ibarra, Jennifer Spinti, Philip Smith</i>	
<b>(266e) Thermal Characterization of Ash Deposits in a 1.5 MW Reactor</b> .....	73
<i>Teri Snow Draper, Mariana Yared, Guilherme Pacheco, Eric Eddings, Terry A. Ring</i>	
<b>(266f) Techno-Economic Analysis of Gas Purification for CO<sub>2</sub> Transport in Pipeline Networks and Injection for Storage</b> .....	74
<i>Clea Kolster, Evgenia Mechleri, Sam Krevor, Niall Mac Dowell</i>	
<b>(377a) Accelerate Materials Design through Accurate Performance Prediction</b> .....	76
<i>Regis Conrad</i>	
<b>(377b) Democratizing Fossil Fuel Conversion</b> .....	77
<i>Dane A. Boysen</i>	
<b>(377c) Oxy-Coal Power Boiler Simulation and Validation through Extreme Computing</b> .....	78
<i>Philip Smith</i>	
<b>(377d) Impact of US Natural Gas Abundance on Carbon Management Strategies</b> .....	79
<i>Roger D. Aines</i>	
<b>(402a) Autothermal Reforming of Diesel Fuels on Structured Cordierite Monoliths Coated with Oxide Supports and Rh As Active Phase</b> .....	80
<i>Joachim Pasel, Sebastian Wohlrab, Katrin Löhken, Mikhail Rotov, Ralf Peters, Detlef Stolten</i>	
<b>(402b) Performance of Monolithic Catalyst for Autothermal Reforming of Diesel for APU (Auxiliary Power Unit) Applications</b> .....	89
<i>Minseok Bae, Jiwoo Oh, Dongyeon Kim, Fahad I. Muhaish, Sai P. Katikaneni, Joongmyeon Bae</i>	
<b>(402c) Highly Efficient Fuel Processor and System for Hydrogen Production</b> .....	90
<i>Christian Junaedi, Saurabh A. Vilekar, Curtis Morgan, Dennis Walsh, Subir Roychoudhury</i>	
<b>(402d) Contaminant-Tolerant Fuel Reforming/Upgrading Catalyst for Fuel Cell Systems</b> .....	91
<i>Amit Goyal, Andrew Lucero, Kevin McCabe, Santosh Gangwal</i>	
<b>(402e) Syngas Production By Biogas Steam and Oxy Steam Reforming Processes on Rh/CeO<sub>2</sub> Catalyst Coated on Ceramics Monolith and Open Foams</b> .....	92
<i>Antonio Vita, Muhammad A. Ashraf, Cristina Italiano, Concetto Fabiano, Lidia Pino, Stefania Specchia</i>	
<b>(402f) Hydrogen Production By Steam Reforming of Dimethyl Ether - Development of Catalysts for the Steam Reforming</b> .....	95
<i>Kaoru Takeishi</i>	
<b>(402g) Conversion of Alcohols, Ethers and Light Hydrocarbons - on the Way to Multifuel Reformer</b> .....	96
<i>Pavel Snytnikov, Arkady Malakhov, Aleksey Pechenkin, Sukhe Badmaev, Dmitriy Potemkin, Vladimir Belyaev, Valery Kirillov, Vladimir Sobyantin</i>	
<b>Fuel Processing for Fuel Cells in Mobile and Stationary Applications</b> .....	97
<i>Philip Engelhardt, Dirk Henning Braun, Klaus Lucka, Frank Beckmann, Martin Brenner</i>	
<b>(467a) Sustainability Assessment of Direct and Indirect Mechanical Energy Recovery Devices</b> .....	98
<i>Aida Amini Rankouhi, Yinlun Huang</i>	
<b>(467b) Design of CHP Systems for Housing Complexes Under Uncertainty</b> .....	99
<i>Luis Fabian Fuentes-Cortes, José Ezequiel Santibañez-Aguilar, José María Ponce-Ortega</i>	
<b>(467c) The Use of Dimethyl Carbonate for Etherification</b> .....	107
<i>Rodrigo Cella, Alex S. T. Z. Tabu</i>	

<b>(467d) Comparative Life Cycle Analysis of Different Light Bulbs Used for Street Lighting</b> .....	110
<i>Khurram Shahzad, Muhammad Suleman Tahir, Muhammad Sagir, Botond Bertok</i>	
<b>(467e) One Year Operation of a Salinity Gradient Solar Pond in Northern Cyprus</b> .....	111
<i>Soudabeh Gorjinezhad, Sultan Kadyrov, Mohammad Askari, Negar Zare Pakzad, Mehdi Amouei Torkmahalleh, Goodarz Ahmadi, Sitaraman Krishnan</i>	
<b>(467f) Evaluation of Electric Vehicle Energy Consumption for Traveling and Air-Conditioning</b> .....	114
<i>Masashi Murata, Tsuguhiko Nakagawa</i>	
<b>(470a) Dry Reforming of Methane on Ni in a Fixed-Bed Reactor: Spatial Reactor Profiles and Detailed CFD Simulations</b> .....	115
<i>Gregor D. Wehinger, Matthias Kraume, Viktor Berg, Katharina Mette, Malte Behrens, Robert Schlögl, Oliver Korup, Raimund Horn</i>	
<b>(470b) Nickel Supported on Ceria-Zirconia for Syngas Production Via Dry Reforming of Methane</b> .....	117
<i>Monika Radlik, Radoslaw Debek, Krzysztof Koziel, Andrzej Krzton, Wincenty Turek, Patrick Da Costa</i>	
<b>(470c) Dry Reforming of Methane over Ni-Based Pyrochlore Catalysts Using Transient Pulsing</b> .....	120
<i>Nitin Kumar, Daniel J. Haynes, Dushyant Shekhawat, David Berry, Devendra Pakhare, James J. Spivey</i>	
<b>(470d) Catalytic Production of Hydrogen and Carbon Monoxide Via Methane Dry Reforming Reaction over Hydrotalcite-Derived Ni/Mg/Al Mixed Oxides Promoted with Zr and/or Ce</b> .....	121
<i>Radoslaw Debek, Monika Motak, Elena Galvez, Teresa Grzybek, Patrick Da Costa</i>	
<b>(470e) ATR-Based Compact Reactor System for the Distributed Hydrogen Production</b> .....	123
<i>Vincenzo Palma, Antonio Ricca, Biagio Addeo, Maurizio Rea, Gaetano Paolillo, Paolo Ciambelli</i>	
<b>(470f) Sensitivity and Economical Analysis of Fuel Processors Based on SR Integrated with WGS and PSA for Pure Hydrogen Production from Natural Gas</b> .....	126
<i>Muhammad A. Ashraf, Giuliana Ercolino, Vito Specchia, Stefania Specchia</i>	
<b>(470g) Modeling Transport and Reaction in Porous Catalyst Washcoat for Steam Methane Reforming in a Microchannel Reactor By CFD with Elementary Kinetics</b> .....	128
<i>Chenxi Cao, Nian Zhang, Yi Cheng</i>	
<b>(477a) Pervaporative Enrichment of 1,3-Propanediol from Model Fermentation Broths By Hydrophobic Specialty Polymers</b> .....	129
<i>Baishali Kanjilal, Iman Noshadi, Richard Parnas, Alesandru Asandei, Jeffrey McCutcheon</i>	
<b>(477b) Implementation of a Customized Gas-Separation Membrane Model into Commercial Flowsheeting Software to Simulate a Hybrid CO<sub>2</sub> Removal Process for Oxidative Coupling of Methane</b> .....	130
<i>Alberto Penteado, Erik Esche, Günter Wozny</i>	
<b>(477c) Membrane-Based Process for the Continuous Enzymatic Saccharification of Lignocellulosic Biomass</b> .....	139
<i>Birendra Adhikari, John Pellegrino, David A. Sievers, Jonathan Stickle</i>	
<b>(477d) Recovery of Nutrients from Swine Wastewater Using Ultrafiltration: Applications for Microalgae Cultivation in Photobioreactors</b> .....	140
<i>Heather Sandefur, Jamie A. Hestekin</i>	
<b>(477e) Use of Forward Osmosis in Treatment of Hyper-Saline Produced Water</b> .....	141
<i>Mustafa Al-Furaiji, Maqsood Chowdhury, Jason T. Arena, Nieck E. Benes, Jeffrey McCutcheon</i>	
<b>(477f) Membrane Distillation for Separating Water from Ionic Liquid Solutions</b> .....	142
<i>Joan G. Lynam, Charles J. Coronella, Sage R. Hiibel</i>	
<b>(531a) The Research on a Polyamidoamine-Based Demulsifier for Oil/Water Separation</b> .....	143
<i>Luhong Zhang, Xing Yao, Xiaoming Xiao</i>	
<b>(531b) Three Types of Filter Media Produced from Electrospun Cellulose Acetate (Cac)-Polystyrene (PS) Composite Membrane for Separating Oil-Water Mixtures</b> .....	144
<i>Lida Baghernejad, Erin Iski, Ovadia Shoham, Ram S. Mohan, Seyi A. Oduyungbo</i>	
<b>(531c) Reducing Drilling Fluid Losses Using a Lab Scale Shale Shaker</b> .....	145
<i>Rubens Gedraite, Sergio Neiro, Fernando Guerreiro, Carlos Ataide, Carlos Sá</i>	
<b>(531d) Destabilization and Treatment of Produced Oil-Water Emulsions from EOR Application Using Polyacrylamides</b> .....	146
<i>He Ma, Abdullah S. Sultan, Mustafa Nasser</i>	
<b>(531e) Destabilization and Treatment of Produced Water-Oil Emulsions Using Anionic Polyacrylamide and Electrolyte of Aluminum Sulphate and Ferrous Sulphate</b> .....	147
<i>Abdullah S. Sultan, He Ma, Mustafa Nasser</i>	
<b>(531f) Reliable Use of a Baghouse in High-SO<sub>3</sub> Environment</b> .....	148
<i>Noah D. Meeks, Ramsay Chang</i>	
<b>(532a) Solar Thermo Microchemical Reforming of Natural Gas for Sustainable, Distributed Production of Hydrogen</b> .....	149
<i>Ronald Besser</i>	
<b>(532b) Perovskite-Structured Redox Catalysts for Methane Partial Oxidation and Water Splitting in a Hybrid Solar-Redox Process</b> .....	160
<i>Feng He, Amit Mishra, Fanxing Li</i>	
<b>(532c) Hydrogen Production Using Mic Membranes for Water Thermolysis with Partial Oxidation of Methane</b> .....	161
<i>Xiao-Yu Wu, Mruthunjaya Uddi, Ahmed F. Ghoniem</i>	
<b>(532d) Kinetics and Reaction Steps of Autothermal Methanol Steam Reforming over CuO-ZnO-Al<sub>2</sub>O<sub>3</sub> Catalyst</b> .....	162
<i>Dong Hyun Kim, Jietae Lee, Hyunchan Lee</i>	
<b>(532e) Layered-Double-Hydroxide-Derived Cu Catalysts for Methanol-Steam Reforming Reaction</b> .....	165
<i>Woohyun Kim, K. M. Khaja Mohiadeen, Wang Lai Yoon</i>	

<b>(532f) CO Preferential Oxidation and Methanation Catalysts and Their Performance for CO-Cleanup of Hydrogen-Rich Stream</b> .....	166
<i>Pavel Snytnikov, Vladimir Sobyenin</i>	
<b>(532g) Coal Pyrolysis Gas Chemical Looping Combustion and Hydrogen Production in a Packed Bed Reactor: The Performance of Iron-Based Oxygen Carrier Using Al<sub>2</sub>O<sub>3</sub> and Coal Fly Ash As Supports</b> .....	167
<i>Xin Huang, Maohong Fan, Yonggang Wang</i>	
<b>(532h) Comparative Study on Red Mud Gasification of Coal/Biomass Mixtures</b> .....	168
<i>Foster A. Agblevor, Oleksandr Hietsoi, Guevara C. Nyendu, Francine Battaglia</i>	
<b>(602a) CO<sub>2</sub> Utilization in the Production of Ethylene Oxide</b> .....	169
<i>Paul Mobley, Marty Lail, Jonathan Peters</i>	
<b>(602b) Dihydropteridine/Pteridine As a 2H<sup>+</sup>/2e<sup>-</sup> Redox Mediator for the Catalytic Reduction of CO<sub>2</sub> to Methanol Via Hydride-Proton Transfer</b> .....	171
<i>Charles B. Musgrave, Chern-Hooi Lim, Aaron Holder, James T. Hynes, Yu-Ching Kuo</i>	
<b>(602c) Highly Efficient Catalytic Reactor for CO<sub>2</sub> Conversion to Value-Added Chemicals</b> .....	172
<i>Kyle Hawley, Christian Junaedi, Dennis Walsh, Subir Roychoudhury</i>	
<b>(602d) Methanol and Formic Acid Syntheses Using Captured CO<sub>2</sub> As Raw Material: Techno-Economic and Environmental Assessments</b> .....	173
<i>Mar Pérez-Fortes, Jan Schöneberger, Aikaterini Boulamanti, Gillian Harrison, Evangelos Tzimas</i>	
<b>(602e) Modeling of Particle Size Distribution in Supercritical Antisolvent Recrystallization Process</b> .....	184
<i>Rahul Kumar, Hari Mahalingam</i>	
<b>(602f) The Effects of Variation in CO<sub>2</sub> Stream Composition and Flow Rate on Enhanced Oil Recovery and Geologic Storage</b> .....	185
<i>Melanie D. Jensen, Steven M. Schlasner, James A. Sorensen, John A. Hamling</i>	
<b>(602g) Low Temperature Hydrogenation of Amine Captured CO<sub>2</sub></b> .....	186
<i>Hongfei Lin</i>	
<b>(673a) Natural Gas to Chemicals</b> .....	189
<i>Dolly Chitta</i>	
<b>(673b) Nature of the Active Mo Phase of Mo/ZSM-5 Catalysts during Non-Oxidative Conversion of Methane Reaction</b> .....	190
<i>Yadan Tang, Gallagher James R., Jeffrey T. Miller, Jie Gao, Simon G. Podkolzin, Israel E. Wachs</i>	
<b>(673c) Oxidative Coupling of Methane on Na<sub>2</sub>WO<sub>4</sub>-Mn/SiO<sub>2</sub>: Impact of Reactor Type</b> .....	191
<i>Aseem Aseem, Michael P. Harold</i>	
<b>(673d) Ceramic Membrane Reactor for Hydrogen and Chemicals Production from Methane</b> .....	193
<i>Mann Sakbodin, Dongxia Liu, Eric D. Wachsman</i>	
<b>(673e) Examination of Oxidative Coupling of Methane By Traditional Catalysis and Chemical Looping with Manganese-Based Oxides</b> .....	194
<i>Elena Y. Chung, William K. Wang, Hussein Alkhatib, Sourabh Nadgouda, Michael Jindra, John A. Sofranko, Liang-Shih Fan</i>	
<b>(673f) Catalytic Effects of CeO<sub>2</sub> and/or La<sub>2</sub>O<sub>3</sub> on Fe<sub>2</sub>O<sub>3</sub>-Al<sub>2</sub>O<sub>3</sub> Based Chemical-Looping Dry (CO<sub>2</sub>) Reforming of CH<sub>4</sub></b> .....	195
<i>Mingchen Tang, Maohong Fan</i>	
<b>(705a) Rare Earth Occurrences Proximal to the Cretaceous/Tertiary Boundary</b> .....	196
<i>Thomas Gray, H. T. Andersen, Rex Bryan, Dave Richers</i>	
<b>(705b) Recovery of RARE Earth Minerals and Elements from Coal and Coal Byproducts</b> .....	209
<i>Rick Honaker, Jack Groppo, Venkata Abhijit Bhagavatula, Mohammad Rezaee, Wencai Zhang</i>	
<b>(705c) Uncertainties and Optimum Detection Modes for Rare Earth Analysis in Coal and Coal Ash Using Inductively Coupled Plasma Mass Spectrometry (ICP-MS)</b> .....	210
<i>Elliot Roth, Tracy Bank, Evan J. Granite</i>	
<b>(705d) Analysis of Twenty Coal Ashes for Rare Earth Element Content Using Inductively Coupled Plasma Mass Spectrometry (ICP-M)</b> .....	211
<i>Elliot Roth, Tracy Bank, Evan J. Granite</i>	
<b>(705e) Characterization of Rare Earth Elements in Canadian Oil Sand Process Streams</b> .....	212
<i>Elliot Roth, Tracy Bank, Evan J. Granite</i>	
<b>(705f) Deep Eutectic Solvents and Ionic Liquids for Extraction of Rare Earth Elements from Coal Ash</b> .....	213
<i>Elliot Roth, Megan Macala, Tracy Bank, Evan J. Granite</i>	
<b>(736a) U.S. Doe Carbon Storage R&amp;D Program: Advancing Carbon Storage Technologies Towards Commercialization</b> .....	214
<i>Kanwal Mahajan, Traci Rodosta, Derek M. Vikara</i>	
<b>(736b) Midwest Regional Carbon Sequestration Partnership: Importance of Field Projects and Regional Mapping to Demonstrate Geologic Storage Potential</b> .....	215
<i>Neeraj Gupta, Lydia Cumming, Mark Kelley, Jacqueline Gerst</i>	
<b>(736c) Post Injection Site Care (PISC) at the Secarb Anthropogenic Test</b> .....	231
<i>David Riestenberg, George J. Koperna, Robert Trautz, Richard Rhudy</i>	
<b>(736d) Hydrocarbon Mobilization and Potential CO<sub>2</sub> Storage Mechanisms in the Middle Bakken, Bakken Shales, and Three Forks</b> .....	232
<i>Steve Hawthorne, James A. Sorensen, Charles D. Gorecki, Edward N. Steadman, John A. Harju, Steve Melzer</i>	
<b>(736e) How Do You Make Key Risk Management Decisions for Engineered Geologic Carbon Storage Systems in Face of Uncertainties?</b> .....	234
<i>Rajesh Pawar</i>	
<b>(736f) CO<sub>2</sub> Sequestration Capacity Estimations for Jacksonburg-Stringtown Oil Field, West Virginia, USA</b> .....	235
<i>Zhi Zhong, Timothy Carr</i>	

<b>(756a) Impact of Model Complexity for Carbon Dioxide Migration in Structured Heterogeneous Domains.....</b>	236
<i>Karl Bandilla, Michael Celia</i>	
<b>(756b) Large-Scale Release and Dispersion of CO<sub>2</sub>: Experiments and Simulation.....</b>	246
<i>Vagesh Narasimhamurthy, Lorenzo Mauri, Sunil Lakshmiathy, Trygve Skjold, Shaoyun Chen, Yong Chun Zhang</i>	
<b>(756c) Plugged Well Leakage Risk Assessment in a Carbon Sequestration Project.....</b>	254
<i>Ben Li</i>	
<b>(756d) Effects of Reservoir Temperature and Percent Levels of Methane and Ethane on CO<sub>2</sub>/Oil MMP Values As Determined Using Vanishing Interfacial Tension/Capillary Rise.....</b>	266
<i>Steve Hawthorne, David Miller, Charles D. Gorecki, James A. Sorensen, Edward N. Steadman, John A. Harju</i>	
<b>(756e) The Effects of Quartz Crystal Form on the Formation of Residual Water in Brine-CO<sub>2</sub>-Quartz Systems .....</b>	268
<i>Jingxia Wang</i>	
<b>Impacts of Relative Permeability on Subsurface CO<sub>2</sub> Mineralization and Storage.....</b>	276
<i>Brian McPherson, Vivek Patil, Nathan Moodie, Adam Olsen, Daniel Stout, Richard Esser</i>	
<b>Author Index</b>	