American Institute of Chemical Engineers

6th Topical Conference on Natural Gas Utilization 2006

Held at the 2006 AIChE Spring National Meeting

April 23-27, 2006 Orlando, Florida, USA

Printed from e-media with permission by:

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

ISBN: 978-1-60423-526-5

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

American Institute of Chemical Engineers

6th Topical Conference on Natural Gas Utilization 2006

Table of Contents

Session 26 - LNG I - Plant & Operation

Papers on LNG plants and Their Operation

CoChair: Yu-Nan Liu

Chair: Chen-Hwa Chiu

 New Advances of LNG in China Anzhong Gu, Xuesheng Lu, Wensheng Lin

15 Integrated Approach for the Design of Refrigeration and Power Systems

Frank L. Del Nogal, Jin-Kuk Kim, Simon J. Perry, Robin Smith

27 Processes for High C2 Recovery from LNG – Part I: Schemes Based on Refluxed Demethanizer

Stanley Huang, Dennis Cook, Jame Yao, Douglas Elliot

42 Validation of the Air Recirculation CFD Simulations on a Multi-Train LNG Plant

Dan Lin, Wing Kong Yee, Philip Diwakar, Vibhor Mehrotra

43 Reduction of Flare Loading during a Refrigerant Compressor Blocked Discharge in a LNG C3/MR Process Matthew J. Okasinski, Myrian A Schenk

52 LNG as a Source of Clean Energy Chen-Hwa Chiu

 Definition of Hydraulic Efficiency of Two-Phase Expanders Driven by Boiling Liquid
 Christopher Finley

Session 60 - LNG II - Technology & Equipment

Issues of LNG Technology and Equipment

CoChair: Yoshitsugi Kikkawa

Chair: Chen-Hwa Chiu

64 LNG-Fired Peak-Shaving Power Plants in China Xuesheng Lu, Wensheng Lin, Anzhong Gu

71 A Flexible LNG Conditioning and NGL Recovery Process in LNG Receiving Terminal

John Mak, Dick Nielsen, Curt Graham

Processes for High C2 Recovery from LNG – Part II: Schemes
 Based on Expander Technology
 Stanley Huang, Roger Chen, Jame Yao, Douglas Elliot

102 Precooling Concepts for Large Base Load LNG Plants Heinz C. Bauer

- 110 Integrate LNG Terminal with Power Plant to Achieve BTU Control and Efficiency Enhancement
 - Kamal C. Shah, Nimish Dhuldhoya
- 118 Snohvit LNG Leading LNG Business into a Promising Region **Peter Arnim Hortig**
- 128 LNG Applications of Printed Circuit Heat Exchangers **Tony Bowdery**

Session 94 - LNG III - Environment & Energy

Environmental and Energy issues of LNG

CoChair: Harry West

Chair: Chen-Hwa Chiu

- 137 Compressed Natural Gas Engines Exhaust Gas Treatment **Debora Fino**, Nunzio Russo, Guido Saracco, Vito Specchia
- 139 Versatility of Vacuum Jacketed Pipe in LNG Facilities **John W. Bonn**
- Processes for High C2 Recovery from LNG –Part III: Simar Applied to Gas Processing
 Stanley Huang, Roger Chen, Dennis Cook, Douglas Elliot
- 180 NGL Recovery Process Synergies with the LNG Value Chain Michael Barclay, **C. C. Yang**
- 192 Advanced Design of Submerged Combustion Vaporizer for Low Emission OperationNobuya Himoto
- 204 Overview of Open Rack Vaporizer and Intermediate Fluid Type Vaporizer, and Possible Impact of the Warming Water to Environment
 - Masao Endo
- 215 Low Emissions with Advanced Pipeline Gas Heater **Jung-Bin Lee**, Jong-Ho Kim

Session 125 - Process Safety of LNG Production, Transportation and Distribution

Process Safety of LNG Production, Transportation and Distribution

Chair: Dave Jones

230 The Effects of Uncertainty on Quantified Risk Assessment for LNG Facilities

Doug Hobbs

243 Lessons Learned from the Application of Risk Management in the Shipment of LNG (for Ccps)

B.R. Poblete

255 LNG Security Vulnerability Assessment

Dave Moore

Session 128 - Advanced Gas Conversion and Gasification Processes

The symposium will primarily deal with the recent advances in production of syngas from natural gas, as the first step to add value to the resources. Papers related to gasification processes for refinery use of petroleum coke, heavy oil, oil sands bitumen, kerogen from shale oil and other hydrocarbons for making hydrogen, fuel components, or fuels are appropriate for this session.

CoChair: Rameshwar Srivastava
Chair: Venkat Venkataraman

- 277 I T M Syngas: Ceramic Membrane Technology for Lower Cost Conversion of Natural Gas Christopher M. Chen, Douglas L. Bennett, Michael F. Carolan, Christopher F. Miller, James J. Steppan, William E. Waldron
- 283 Metal Promoted Binary Oxides of Ceria and Zirconia for Low Temperature Water-Gas Shift Gary Jacobs, Sandrine Ricote, Yaying Ji, Patricia M. Patterson, Burtron H. Davis
- 289 Efficiencies in Small Scale Hydrogen Production by Methane Steam Reforming in High Temperature Catalytic and Low Temperature Plasma Processes
 - Trung Pham, Trung Hoang, Richard G. Mallinson, Lance Lobban
- 297 Oxidative Coupling of Methane Enhanced by Thermally Optimized Reactors and Intermediate Separation

 Ames Kulprathipanja, Alexander S. Lindquist, Joseph C.
 Poshusta, Jerry L. Martin
- 304 Development and Evaluation of the Gasification Technology as Alternative Power Generation

 Emilio Manzanares-Papayanopoulos, Manuel Fernández-Montiel, Jorge A. Altamirano-Bedolla, Agustín Moisés Alcaraz-Calderón, César A. Romo-Millares
- Optimization of Amins Mixture `S Formulation by Neural Networks in Gas Sweeting iman Farasat, Mohammad Samipoor giri, Mojtaba Shariati Niasar

Session 138 - LNG IV - Control & Simulation

Papers on Controlling and Simulating LNG Processes

CoChair: Hans Kimmel
Chair: Chen-Hwa Chiu

- 319 CFD Study on Natural Gas Fluidized Bed Combustors
 Felix Severino Farias Junior, Rubens Maciel Filho, Sergio Lucena,
 Jornandes Dias Silva
- 325 Rasgas Makes Extensive Use of Process Operator Training Simulators in LNG Operations

 Ahmet Pekediz. James M. Dawson, John W. Womack

- 334 Performance Characteristics of LNG Tandem Expanders Hans Kimmel, Chen-Hwa Chiu
- 335 Pressure Induced Non-Linear Oscillations in Two-Phase LNG Pipe

Andrew Kimmel

- 346 How Big Is the Area Required for LNG Base Load Plant and Their **Design Considerations** J. C. Kuo
- 358 LNG Rollover: Converting a Safety Problem to Tank Loading **Operational Asset** YanJun Wang, Harry West
- 371 A Step Change in LNG Operations through Advanced Process Control

Kees Den Bakker

Session 181 - Fischer-Tropsch and Alternative Syngas Conversion Processes

Gas Conversion to Liquid Fuels and Related Advance Fuels symposium will primarily deal with the conversion of natural gas, associated gas and/or synthesis gas to liquid fuels and related advanced products that both add value to the gas resource and improve refinery operations.

Cochairs: Rameshwar Srivastava Christopher M. Chen

- Overview of Fischer-Tropsch Products and Their Upgrading to **Useful Products** Mingsheng Luo, Stephen C. LeViness, Gary Jacobs, Burtron H. **Davis**
- 383 Fischer-Tropsch Synthesis with Ultrafine Iron-Based Catalyst: Nano-Scale Growth of Particles and Associated Effects on Wax/Catalyst Separation Amitava Sarkar, U. M. Graham, J. K. Neathery, R. L. Spicer, Burtron H. Davis
- Conversion of Synthesis Gas to Gasoline 389
 - Finn Joensen
- 390 Enhanced Natural Gas Conversion into Methanol in a Membrane **Driven Reactor**
 - SAVVAS VASILEIADIS, Zoe Ziaka-Vasileiadou
- 401 One-Step Dimethyl Ether Synthesis from Carbon Monoxide-Rich Syngas in a Slurry Reactor Yongwon Seo, Sung-Ho Jo, Ho-Jung Ryu, Chang-Keun Yi, Gyoung-Tae Jin
- Rcc Algorithm for Automated Attainable Regions Analysis: 402 Methanol Synthesis

Tumisang Seodigeng, B. Hausberger, D. Hildebrandt, D. Glasser

Session 183 - LNG V - Cost & Facilities

LNG Costs and Facilities

CoChair: Joseph Cho
Chair: Chen-Hwa Chiu

405 Understanding Ambient LNG Vaporizers **James F. Davis**, Jay Kiper

419 Technical Challenges and Design Features of the Largest LNG Tank in Korea

Eui-Seung Park, Hong-Sung Kim, Seung-Beom Hong, Joseph Cho

Maintenance and Inspection Methodologies for LNG Liquefaction Plants and Terminals
 Dominik T. Uznanski, Gjermund Våge, Jens Petter Tronskar

437 LNG SMART™ Vaporization Process **Ned Baudat**

445 Optimization of Ambient Air Vaporization Processes Joseph Cho, Robert M. Femat, Heinz Kotzot, Charles Durr

458 Practical Optimization of LNG Terminal Process In-Soo Chun, Chang-Hag Kim

473 SCV (Submerged Combustion Vaporizer) with Low Emission - Flameless Burner Technology
Pete W. Falcone, **Frank Maupay**, Ed R. Vogel

Session 222 - LNG VI - Risk & Safety

Issues of Risk and Safety in LNG

CoChair: Harry West
Chair: Chen-Hwa Chiu

483 Safety Management Activities on LNG Industry in Korea **Kyoshik Park**, Dal-Young Park, Ji-Yoon Kim

486 LNG Liquefaction Plant Risk Management Robert Dimitroff

500 Risk Comparison of off Shore Vs. Onshore LNG Terminals **Cynthia Spitzenberger**, Cindy Wei

513 Details of 35 M Diameter LNG Fire Tests Conducted in Montoir, France in 1987 - Analysis of Fire Spectral and Other Data **Hugues Malvos**

533 A Non-Equilibrium Model for Bleve Simulation **Wensheng Lin**, Anzhong Gu, Xuesheng Lu

547 Uncertainties in Modelling the Physical Behaviour of Large LNG Releases upon Sea-Water

Freddie Kootstra

563 Experience with FEM3A
Jerry Kim, Jane Wang, Harry West, Sam Mannan, Jaffe Suardin,
Ben Cormier

Session 228 - Synthetic Fuels from Oil Shale, Coal and Natural Gas

The symposium will primarily deal with recent advances in the production of gaseous and liquid hydrocarbons from unconventional resources, including oil shale. Papers dealing with modeling approaches, R&D activities aimed at commercialization, and current commercial operations are appropriate for this session.

Cochairs: Venkat Venkataraman Rameshwar Srivastava

Chair: Hugh D. Guthrie

575 Comparison of the Acceptability of Various Oil Shale

Processes

Alan K. Burnham, James R. McConaghy

Overview of Retorting of Eastern Oil Shale

Burtron H. Davis

591 An Economic Perspective of above-Ground Oil Shale

Retorting R&D Needs

Robert Vagnetti, Lawrence J. Shadle

R&D Data Gaps Identified for Model Development of Novel in

Situ Oil Shale Conversion Process

Lawrence J. Shadle, Mark Smith, Esmail R. Monazam, Wen-

Ching Yang

593 Compact, Mobile Synthetic Fuel Unit

Kai Jarosch, Terry Mazanec, Jeff McDaniel, Anna Lee

Tonkovich, Sean Fitzgerald

595 Opportunities for Co-Feeding Coal and Natural Gas to a

Liquids Plant

Diane. Hildebrandt, David Glasser, B. Patel, B. Hausberger