

# **International Symposium on Oilfield Chemistry 2011**

**The Woodlands, Texas, USA  
11-13 April 2011**

**Volume 1 of 2**

**ISBN: 978-1-61782-742-6**

**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© (2011) by the Society of Petroleum Engineers  
All rights reserved.

Printed by Curran Associates, Inc. (2011)

For permission requests, please contact the Society of Petroleum Engineers  
at the address below.

Society of Petroleum Engineers  
P. O. Box 833836  
Richardson, Texas 75083-3836

Phone: (800) 456-6863  
Fax: (972) 952-9435

[books@spe.org](mailto:books@spe.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

## Volume 1

|  |     |
|--|-----|
| <b>SPE 139815 Sandstone Acidizing Using a New Class of Chelating Agents</b> .....  | 1   |
| <i>M. A. Mahmoud, H. A. Nasr-El-Din, C. A. De Wolf, A. K. Alex</i>   |     |
| <b>SPE 139816 Reaction of GLDA with Calcite: Reaction Kinetics and Transport Study</b> .....   | 18  |
| <i>Ahmed I. Rabie, Mohamed A. Mahmoud, Hisham A. Nasr-El-Din</i>   |     |
| <b>SPE 140141 Effects of Injected Water Chemistry on Waterflood Sweep Efficiency via Induced Fines Migration</b> .....   | 38  |
| <i>Phillip Lemon, Abbas Zeinjahromi, Pavel Bedrikovetsky, Ibrahim Shahin</i>   |     |
| <b>SPE 140177 Laboratory and Field Studies of Long-term Release Rates for a Solid Scale Inhibitor</b> .....  | 55  |
| <i>J. Mike Brown, Dong Shen, D. V. Satya Gupta, Grahame Taylor, Richard W. Self</i>  |     |
| <b>SPE 140401 The Laboratory Evaluation and Optimization of Hydrogen Sulphide Scavengers Using Sulphur Specific Flame Photometric Gas Chromatography</b> .....   | 62  |
| <i>Grahame N. Taylor, Ron Matherly</i>   |     |
| <b>SPE 140439 An Example of Chemical Recycling in the Oil and Gas Industry - A By-product from Hydrogen Sulphide Scavenging is Identified, Isolated and Formulated into a Highly Effective Corrosion Inhibitor</b> ..... | 73  |
| <i>Grahame N. Taylor</i>   |     |
| <b>SPE 140751 Enhancing Production by Removing Zinc Sulfide Scale From an Offshore Well: A Case History</b> .....  | 85  |
| <i>Sandra L. Berry, Joel L. Boles, Amit Singh, Imran Hashim</i>  |     |
| <b>SPE 140752 “Red” vs. “Green” Scale Inhibitors for Extending Squeeze life – A Case Study From North Sea, Norwegian Sector – Part II</b> .....  | 98  |
| <i>M. M. Jordan, E. Sorhaug, D. Marlow</i>   |     |
| <b>SPE 140779 Injectivity of Hydrophobically Modified Water Soluble Polymers for IOR: Controlled Resistance Factors vs. Flow-Induced Gelation</b> .....  | 113 |
| <i>Guillaume Dupuis, David Rousseau, René Tabary, Bruno Grassl</i>   |     |
| <b>SPE 140780 Environmentally Acceptable Polymeric Corrosion Inhibitors</b> .....  | 126 |
| <i>Per-Erik Hellberg</i>   |     |
| <b>SPE 140817 High-Efficiency Boron Crosslinkers for Low-Polymer Fracturing Fluids</b> .....   | 142 |
| <i>Hong Sun, Qi Qu</i>   |     |
| <b>SPE 140838 Optimizing Paraffin and Naphthene Wax-Treatment Options Using Cross-Polarized Microscopy</b> .....   | 151 |
| <i>Mark M. Bacon, Laura B. Romero-Zerón</i>  |     |
| <b>SPE 140845 Improvements to Hydrophobically Modified Water-Soluble Polymer Technology to Extend the Range of Oilfield Applications</b> .....   | 158 |
| <i>Larry Eoff</i>  |     |
| <b>SPE 140860 Selection of the Right Demulsifier for Chemical Enhanced Oil Recovery</b> .....  | 170 |
| <i>D. T. Nguyen, N. Sadeghi</i>  |     |
| <b>SPE 140868 Development of Water-Based Drilling Fluids Customized for Shale Reservoirs</b> .....   | 182 |
| <i>Jay P. Deville, Brady Fritz, Michael Jarrett</i>  |     |
| <b>SPE 140892 Controlled Release of Colloidal Particles and Remediation: Experimental Investigation and Modelling</b> .....  | 192 |
| <i>A. Gravelle, Y. Peysson, R. Tabary, P. Egermann</i>   |     |
| <b>SPE 140959 A Novel Fluid to Improve the Hydraulic Cracking Stress of Rock</b> .....   | 203 |
| <i>Brian Grady, Shuqing Wu, Gary P. Funkhouser</i>   |     |
| <b>SPE 140965 Preparation of Novel Amphoteric Flocculant and Its Application in Oilfield Water Treatment</b> .....   | 211 |
| <i>Hui Song</i>  |     |
| <b>SPE 140977 Field Study of the Physical and Chemical Factors Affecting Downhole Scale Deposition in the North Dakota Bakken Formation</b> .....  | 224 |
| <i>Lawrence M. Cenegy, Clyde A. McAfee, Leonard J. Kalfayan</i>  |     |
| <b>SPE 141005 Chemical Modification of Biopolymers to Design Cement Slurries with Temperature-Activated Viscosification</b> .....  | 236 |
| <i>B. R. Reddy, Rahul Patil, Sandip Patil</i>  |     |
| <b>SPE 141007 Viscosification-on-Demand: Chemical Modification of Biopolymers to Control Their Activation by Triggers in Aqueous Solutions</b> .....   | 247 |
| <i>B. R. Reddy</i>   |     |

|   |     |
|---|-----|
| <b>SPE 141016 Experimental Study of Spreading and Wettability Effects by Surfactants in Condensate Reservoirs at Reservoir Conditions</b> .....   | 264 |
| <i>Y. Zheng, D. N. Rao</i>  |     |
| <b>SPE 141025 Development and Application of Foamers to Enhance Crude Oil Production</b> .....  | 280 |
| <i>Saet Byul Debord, Scott Lehrer, Nancy Means, Simon Crosby</i>  |     |
| <b>SPE 141031 Carbon Dioxide, Geochemical, and Rate-of-Dissolution Simulation for Deep Storage Environments</b> .....   | 293 |
| <i>Ismail Ceyhan, Ashok Santra, A. S. Cullick</i>   |     |
| <b>SPE 141033 The Impact of Organic Acid on Scale Inhibitor/Corrosion Inhibitor Interaction, A Case Study from West Africa</b> .....  | 310 |
| <i>K. J. Spicka, C. J. Johnston, M. M. Jordan, L. T. Nguyen, S. L. Samaniego, L. Sutherland</i>   |     |
| <b>SPE 141037 Biphasic Viscosity Reducers as Production Aids for Viscous Oils</b> .....   | 318 |
| <i>M. Faust Jr., Thomas Weathers Jr.</i>  |     |
| <b>SPE 141099 Environmentally-Acceptable Replacement of 2-Butoxyethanol: A High Performance Alternative for Fracturing Applications</b> .....   | 326 |
| <i>Jonathan J. Wylde, Bill O'Neil</i>   |     |
| <b>SPE 141100 Scale Inhibitor Application in Northern Alberta - A Case History of an Ultra High Temperature Scale Inhibition Solution in Fire Tube Heater Treaters</b> .....                                      | 342 |
| <i>Jonathan J. Wylde, Keith Allan, Jeff McMahon, Steve Mayner</i>   |     |
| <b>SPE 141107 Hydrophobic Associative Copolymer with Favorable Properties for the Application in Polymer Flooding</b> .....   | 356 |
| <i>Roland Reichenbach-Klinke, Björn Langlotz, Benjamin Wenzke, Christian Spindler, Gregor Brodt</i>   |     |
| <b>SPE 141113 Shear Stability of EOR Polymers</b> .....   | 367 |
| <i>A. Zaitoun, P. Makakou, N. Blin, R. S. Al-Maamari, A. R. Al-Hashmi, M. Abdel-Goad, H. H. Al-Sharji</i>   |     |
| <b>SPE 141145 Evaluation of Scale Inhibitors in Marcellus Waters Containing High Levels of Dissolved Iron</b> .....   | 374 |
| <i>Dong Shen, David Shcolnik, Randall Perkins, Grahame Taylor, J. Mike Brown</i>  |     |
| <b>SPE 141146 Method for Identification and Analysis of Polysaccharide-Based, Hydraulic-Fracture Flowback Fluid</b> .....   | 386 |
| <i>Kurt Hoeman, Scott Klasner, Arron Karcher</i>  |     |
| <b>SPE 141148 Predicting Asphaltene Precipitation in Oilfields via the Technology of Compositional Reservoir Simulation</b> .....   | 391 |
| <i>Waleed Fazelipour</i>  |     |
| <b>SPE 141166 Rheology and Stability of Non-Aqueous Micro Bubble Based Drilling Fluids</b> .....  | 407 |
| <i>S. Shivhare, E. Kuru</i>   |     |
| <b>SPE 141179 Study on Admixtures for Calcium Aluminate Phosphate Cement Useful to Seal CCS Wells</b> .....   | 417 |
| <i>F. Dugonjic-Bilic, C. Tiemeyer, J. Plank</i>   |     |
| <b>SPE 141182 Formation of Colloidal Polymer Associates from Hydroxyethyl Cellulose (HEC) and Their Role to Achieve Fluid Loss Control in Oil Well Cement</b> .....   | 429 |
| <i>D. Buelichen, J. Plank</i>   |     |
| <b>SPE 141202 New Steam Resilient Cement: Evaluation of Long-term Properties Under Extreme Conditions</b> .....   | 440 |
| <i>Alice Chougnet-Sirapian, Elena Pershikova, Anthony Loiseau</i>   |     |
| <b>SPE 141211 Case Study: Evaluation of an Oxidative Biocide During and After a Hydraulic Fracturing Job in the Marcellus Shale</b> .....   | 455 |
| <i>Shawn M. Rimassa, Paul Howard, Bruce Mackay, Kristel Blow, Noel Coffman</i>  |     |
| <b>SPE 141217 Treatment of Mercaptans in Canadian Condensate</b> .....  | 465 |
| <i>Joseph Arensdorf, Darin Horaska</i>  |     |
| <b>SPE 141226 The Effect of Surfactants on the Kinetics of Hydrate Formation</b> .....  | 469 |
| <i>Divya Ramaswamy, Mukul M. Sharma</i>   |     |
| <b>SPE 141242 Development of New Chemical Additive Detection Methods Inspired by the Life Sciences</b> .....  | 484 |
| <i>Anne-Marie Fuller, Fiona Mackay, Cameron Mackenzie, Catherine Rowley-Williams, Emma Perfect</i>  |     |
| <b>SPE 141256 Liquid Screen: Pickering Emulsion Templating as an Effective Route for Forming Permeable and Mechanically Stable Void-Free Barriers for Hydrocarbon Production in Subterranean Formations</b> ..... | 496 |
| <i>V. O. Ikem, A. Menner, A. Bismarck, L. R. Norman</i>   |     |

Volume 2

|  |     |
|--|-----|
| <b>SPE 141257 Novel Drag-Reducing Agents for Fracturing Treatments Based on Polyacrylamide Containing Weak Labile Links in the Polymer Backbone</b> .....    | 505 |
| <i>E. Kot, A. Bismarck, R. K. Saini, L. R. Norman</i>  |     |
| <b>SPE 141260 Associative Polymer System Extends the Temperature Range of Surfactant Gel Frac Fluids</b> .....   | 516 |
| <i>D. V. Satya Gupta, Paul S. Carman</i>   |     |
| <b>SPE 141286 New Compounds for Hydrogen Sulfide Scavenging and Iron Sulfide Control</b> .....   | 524 |
| <i>Carl W. Aften, Gayla Roberts</i>  |     |
| <b>SPE 141296 Surfactant Modeling for Insight into Load-Recovery Enhancement for Fracturing Treatments</b> .....   | 544 |
| <i>Rick Gdanski, Gary P. Funkhouser</i>  |     |
| <b>SPE 141298 An Experimental Study of a New VES Acid System: Considering the Impact of CO<sub>2</sub> Solubility</b> .....                                  | 561 |
| <i>Ahmed M. Gomaa, Guanqun Wang, Hisham A. Nasr-El-Din</i>   |     |
| <b>SPE 141315 The Effect of Chemistry and System Conditions on Hydrate Interparticle Adhesion Forces Toward Aggregation and Hydrate Plug Formation</b> ..... | 578 |
| <i>Zachary M. Aman, Guro Aspenes, E. Dendy Sloan, Amadeu K. Sum, Carolyn A. Koh</i>  |     |
| <b>SPE 141327 The Use of Zinc Dialkyl Dithiophosphate as a Lubricant Enhancer for Drilling Fluids Particularly Silicate-based Drilling Fluids</b> .....      | 587 |
| <i>Zen-Yu Chang, David Breeden, Michael McDonald</i>   |     |
| <b>SPE 141329 Study of CO<sub>2</sub> Effect on Asphaltene Precipitation and Compositional Simulation of Asphaltenic Oil Reservoir</b> .....                 | 594 |
| <i>M. Choiri, A. A. Hamouda</i>  |     |
| <b>SPE 141331 Effect of Alkalinity on Oil Recovery during Polymer Floods in Sandstone</b> .....  | 609 |
| <i>Mahdi Kazempour, Eric Sundstrom, Vladimir Alvarado</i>  |     |
| <b>SPE 141349 Ultra-HTHP Scale Control for Deepwater Oil and Gas Production</b> .....  | 626 |
| <i>Chunfang Fan, Wei Shi, Ping Zhang, Haiping Lu, Nan Zhang, Sarah Work, Hamad A. Al-Saiari, Amy T. Kan, Mason B. Tomson</i>                                 |     |
| <b>SPE 141352 Determining Microbial Activities in Samples from the Shale Gas Field Compromising Water Reuse and Disposal</b> .....                           | 641 |
| <i>A. Agrawal, I. Chatterjee, G. Voordouw, B. P. Lomans, C. Kuijvenhoven, J. Henderson</i>   |     |
| <b>SPE 141354 Souring Treatment with Nitrate in Fields from which Oil is Produced by Produced Water Reinjection</b> .....                                    | 651 |
| <i>G. Voordouw, A. Agrawal, H. S. Park, L. M. Gieg, T. R. Jack, A. Cavallaro, T. Granli, K. Miner</i>  |     |
| <b>SPE 141355 Rheology of a New Sulfonic Associative Polymer in Porous Media</b> .....   | 654 |
| <i>R. S. Seright, Tianguang Fan, Kathryn Wavrik, Hao Wan, Nicolas Gaillard, Cédric Favéro</i>  |     |
| <b>SPE 141358 Critical Evaluation of Biocide-Friction Reducer Interactions Used In Slickwater Fracs</b> .....  | 668 |
| <i>Carl Aften, Javad Paktinat, Bill O'Neil</i>   |     |
| <b>SPE 141384 Modelling the Application of Scale Inhibitor Squeeze Enhancing Retention Additives</b> .....   | 689 |
| <i>O. Vazquez, P. Thanasutives, C. Elliasson, N. Fleming, E. Mackay</i>  |     |
| <b>SPE 141398 Novel Polymeric Additives to Improve Oil Sands Tailings Consolidation</b> .....  | 703 |
| <i>Philip Watson, Raymond Farinato, Thomas Fenderson, Michael Hurd, Pat Macy, Amir Mahmoudkhani</i>  |     |
| <b>SPE 141400 The Analysis of Chemical Processes in Reservoirs Based on the Identification of Injection Water Fraction in Produced Brine</b> .....           | 710 |
| <i>Oleg Ishkov, Eric Mackay, Ken Sorbie</i>  |     |
| <b>SPE 141409 Improved Microbial Control Programs for Hydraulic Fracturing Fluids Used during Unconventional Shale-Gas Exploration and Production</b> .....  | 720 |
| <i>Michael V. Enzien, Bei Yin, Donald Love, Michael Harless, Edward Corrin</i>   |     |
| <b>SPE 141410 Scale Formation Prevention During ASP Flooding</b> .....   | 730 |
| <i>O. Karazincir, S. Thach, W. Wei, G. Prukop, T. Malik, V. Dwarakanath</i>  |     |
| <b>SPE 141419 Correlating Wettability Alteration with Changes in Relative Permeability of Gas Condensate Reservoirs</b> .....                                | 754 |
| <i>S. F. Gilani, M. M. Sharma, D. Torres, M. Ahmadi, G. A. Pope, H. Linnemeyer</i>   |     |
| <b>SPE 141420 Determination of Anhydrite in Reservoirs for EOR</b> .....   | 769 |
| <i>Jose L. Lopez-Salinas, George J. Hirasaki, Clarence A. Miller</i>   |     |
| <b>SPE 141422 Mitigating Silicate Scale in Production Wells in an Oilfield in Alberta</b> .....  | 787 |
| <i>Joseph Arensdorf, Scot Kerr, Kirk Miner, Tyler Ellis-Toddington</i>   |     |
| <b>SPE 141429 Salt-tolerant, Thermally-stable Rheology Modifier for Oilfield Drilling Applications</b> .....   | 792 |
| <i>Jianzhao Wang, Jun Zheng, Osama M. Musa, David Farrar, Bob Cockcroft, Alison Robinson, Robert Gibbison</i>  |     |

|   |      |
|---|------|
| <b>SPE 141434 Understanding the Souring at Bakken Oil Reservoirs</b> .....  | 803  |
| <i>Yevhen I. Holubnyak, Jordan M. Bremer, Blaise A. F. Mibeck, John A. Hamling, Benjamin W. Huffinan, Ryan J. Klapperich, Steven A. Smith, James A. Sorensen, John A. Harju</i> |      |
| <b>SPE 141435 Corrosion-Inhibitor Design for Compatibility with Acid-Gelling Polymers</b> .....   | 809  |
| <i>Juanita Cassidy, Chad Kiser, Chris Smith</i>   |      |
| <b>SPE 141447 Stabilizing Viscoelastic Surfactants in High Density Brines</b> .....   | 830  |
| <i>Ryan Van Zanten</i>  |      |
| <b>SPE 141449 Studies on the Chemical Stability of Glutaraldehyde in Produced Water</b> .....   | 841  |
| <i>Heather R. McGinley, Michael V. Enzien, Gary Jenneman, Jennifer Harris</i>   |      |
| <b>SPE 141451 Minimizing Scale Precipitation in Carbonate Cores Caused by Alkalis in ASP Flooding in High Salinity/High Temperature Applications</b> .....                      | 849  |
| <i>M. A. Bataweel, H. A. Nasr-El-Din</i>  |      |
| <b>SPE 141459 Surface Energy of North American Shales and its Role in Interaction of Shale with Surfactants and Microemulsions</b> .....  | 864  |
| <i>Andrei S. Zelenev</i>  |      |
| <b>SPE 141462 Wettability Alteration and Foam Mobility Control in a Layered 2-D Heterogeneous System</b> .....  | 871  |
| <i>Robert F. Li, George J. Hirasaki, Clarence A. Miller, Shehadeh K. Masalmeh</i>   |      |
| <b>SPE 141471 Silicon-Based Foamants For Foam Assisted Lift Of Aqueous-Hydrocarbon Mixtures</b> .....   | 888  |
| <i>Kalman Koczó, Oleg Tselnik, Benjamin Falk</i>  |      |
| <b>SPE 141472 Enzymatic Synthesis of a Non Ionic Biosurfactant Derived from Ricinoleic Acid and D-glucose: Stability of its Surface Action Properties</b> .....                 | 899  |
| <i>Suzan I. G. De Medeiros, Carlos R. O. Souto, Fabio P. Fagundes, Marta Costa, Avenida Senador Salgado-Filho</i>   |      |
| <b>SPE 141513 Chemical Additives for Improving Compatibility of Drilling Fluid, Completion Fluid, and Other Well-Treatment Fluids for Deepwater Wells</b> .....                 | 911  |
| <i>Xiaoping (Victoria) Qiu, Lee Morgenthaler, Eddy Martch, Hiep Vu, Mootasem Chtay, Vanessa Farrell David</i>   |      |
| <b>SPE 141528 Engineered Nanoparticles for Hydrocarbon Detection in Oil-Field Rocks</b> .....   | 929  |
| <i>Jacob M. Berlin, Jie Yu, Wei Lu, Erin E. Walsh, Lunliang Zhang, Ping Zhang, Wei Chen, Amy T. Kan, Michael S. Wong, Mason B. Tomson, James M. Tour</i>                        |      |
| <b>SPE 141551 Scale Control and Inhibitor Evaluation of an Alkaline Surfactant Polymer Flood</b> .....  | 954  |
| <i>Sho-Wei Lo, Gordon T. Shahin, Gordon Graham, Caroline Simpson, Sam Kidd</i>  |      |
| <b>SPE 141575 Analysis of Sulphonated Polymers in Oilfield Brines</b> .....   | 964  |
| <i>Kirsty Marshall, Mark Kyle, Gordon Graham</i>  |      |
| <b>SPE 141583 Modeling the Effect of Triazine Based Sulphide Scavengers on the in situ pH and Scaling Tendency</b> .....  | 975  |
| <i>N. Goodwin, J. M. Walsh, R. Wright, S. Dyer, G. M. Graham</i>  |      |
| <b>SPE 141590 Modeling and Simulation of Nitrate Injection for Reservoir Souring Remediation</b> .....  | 986  |
| <i>Mehdi Haghshenas, Kamy Sepehrnoori, Steven L. Bryant, Mohammad Ali Farhadinia</i>  |      |
| <b>SPE 141597 Polymer Chemistry Improves Productivity in Tight Gas Hydraulic Fracturing</b> .....   | 1001 |
| <i>Rick Hutchins, Sylvie Daniel, Agustinus Yudho Wirajati, Hemant Ladva, Don Williamson</i>   |      |
| <b>Author Index</b>   |      |