

# **SPE International Oilfield Scale Conference and Exhibition 2018**

Aberdeen, United Kingdom  
20-21 June 2018

ISBN: 978-1-5108-6568-6

**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© (2018) by Society of Petroleum Engineers  
All rights reserved.

Printed by Curran Associates, Inc. (2018)

For permission requests, please contact 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: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

<b>Application of Electroless Nickel Coating as a Scaling Resistant Alloy in Thermal Production</b> .....	1
<i>Da Zhu, Lu Gong, Xiaoyong Qiu, Wenjihao Hu, Jun Huang, Ling Zhang, Vahidoddin Fattahpour, Mahdi Mahmoudi, Jing-Li Luo, Hongbo Zeng</i>	
<b>Carbonate and Sulphide Scale Prediction Modelling in Auto-Scaling Processes: Procedure for the Calculation of Reservoir Fluid Compositions and Scale Profiles in Production Systems using Topside Data</b> .....	10
<i>Duarte J. Silva, Ken S. Sorbie, Giulia Ness, Eric J. Mackay</i>	
<b>Correcting for Mud Filtrate Contamination of Formation Water Samples for Scale Management Planning: A Case Study from the Nova Field, Norwegian North Sea</b> .....	27
<i>R. A. McCarney, S. T. Hatscher, V. S. Droppert</i>	
<b>Development and Field Application of an Iron Tolerant Scale Inhibitor for use in Fracturing Completions and Production</b> .....	46
<i>H. Davies, M. Toole, R. Higgins</i>	
<b>Development and Improvement of a Novel IC-MS Technique for Phosphonate Scale Inhibitors</b> .....	58
<i>Lei Cheng, Christopher Durnell, Sandra Linares-Samaniego, Ian Littlehales, Julie Fidoe, Emerilis Casado-Rivera</i>	
<b>Development of an UV-Vis Spectrophotometric Method for Accurate Determination of Aqueous Sulphides in Exotic Scale Studies</b> .....	71
<i>Y. Alduailej, L. S. Boak, B. Alharbi, A. J. Graham, K. S. Sorbie, H. Oduro, M. Alkhalidi, S. Alqathami</i>	
<b>Development of Novel Iron Sulfide Scale Control Chemicals</b> .....	85
<i>Wei Li, Gedeng Ruan, Narayan Bhandari, Xin Wang, Ya Liu, H. Dushane, M. Sriyathne, Khadouja Harouaka, Yi-Tsung Lu, Guannan Deng, Yue Zhao, Amy T. Kan, Mason Tomson</i>	
<b>Development of the First Readily Biodegradable OECD306 Phosphonated Amino Acid Chemistry for the Control of Calcium Carbonate and Calcium Sulphate in HTHP and UHT Unconventional Productions</b> .....	97
<i>Raul Antonio Di Toto, Frederic Bruyneel, Davide Parravicini, Amy T. Kan, Mason B. Tomson, Fei Yan</i>	
<b>Effect of Magnesium and Ferrous Ions on CaCO<sub>3</sub> Scaling in MEG Regeneration Pre-Treatment</b> .....	125
<i>Xiaoguang Ma, Marte Neteland, Margrethe Broby, Jens-Petter Andreassen, Marion Seiersten</i>	
<b>Effect of Squeeze Treatment Stages Mixing During Injection on Lifetime</b> .....	142
<i>Oscar Vazquez, Eric Mackay, Manuel Raga, Gill Ross</i>	
<b>The Effect of Surface Material on the Mechanics of Calcium Carbonate Scale Deposition</b> .....	153
<i>Khadouja Harouaka, Yi Tsung Lu, Gedeng Ruan, H. Dushanee Sriyathne, Wei Li, Guannan Deng, Yue Zhao, Xin Wang, Amy T Kan, Mason Tomson</i>	
<b>Enhancing Scale Inhibitor Squeeze Retention in Carbonate Reservoirs</b> .....	166
<i>Louise Sutherland, Myles Jordan, Nalco Champion</i>	
<b>Establishing Stable Gas Production by Squeezing a Novel Halite Inhibitor into High Temperature Texas Gas Wells</b> .....	179
<i>Cyril Okocha, Suyun Wang, Anton Kaiser, Jonathan Wylde</i>	
<b>Evaluating Evaporative Processes - Gas Lift Chemical Applications, Halites and Gunking</b> .....	192
<i>Neil Goodwin, Gordon Graham</i>	
<b>Evaluation of Fe(II)/Fe(III) Effect on Barite Scale Inhibitors Under Different Temperatures</b> .....	204
<i>H. Dushanee, M. Sriyathne, Zhang Zhang, Gedeng Ruan, Khadouja Harouaka, Wei Li, Alex Yi-Tsung Lu, Guannan Deng, Xin Wang, Yue Zhao, Amy T Kan, Mason Tomson</i>	
<b>Extending Reservoir Knowledge from the Produced Data</b> .....	215
<i>Oleg Ishkov, Eric Mackay</i>	
<b>Halite Challenges and Mitigation in the Bakken- Experience of Managing High Saline Produced Water from Hydraulically Fractured Wells</b> .....	228
<i>Nan Zhang, Darren Schmidt, Wanjoon Choi, Desikan Sundararajan, Zach Reisenauer, Jack Freeman, Eivind Lie Kristensen, Zhaoyi Dai, Amy Kan, Mason Tomson</i>	
<b>Impact of Gas Hydrate Inhibitors on Halite Scale Precipitation: An Experimental and Morphological Investigation</b> .....	242
<i>Seyed Ahmad Hosseini, Edris Joonaki, Jim Buckman, Bernardo Ruggeri, Bahman Tohidi</i>	
<b>Impact of High Calcium Concentration on Sulfate Scale Prediction at High Temperature from 120 C to 220 C</b> .....	254
<i>Guannan Deng, Amy T. Kan, Zhaoyi Dai, Alex Y. Lu, Khadouja Harouaka, Yue Zhao, Xin Wang, Mason B. Tomson</i>	

<b>Impact of Polymer EOR and Salinity on Barium Sulphate Scale Risk</b> .....	264
<i>M. M. Al Kalbani, E. J. Mackay, K. S. Sorbie, L. Nghiem</i>	
<b>Insights into the Mechanism of Lead Sulfide Pbs Fouling and The Influence of Light Distillate Fraction</b> .....	284
<i>William Keogh, Thibaut Charpentier, Violette Eroini, John Helge Olsen, Frank Møller Nielsen, Salima Baraka-Lokmane, Jon Arne Ellingsen, Oeystein Bache, Anne Neville</i>	
<b>Introduction of Kinetic Effects into the Thermodynamic Modelling of CaCO<sub>3</sub> Scale Precipitation</b> .....	295
<i>Duarte J. Silva, K. S. Sorbie, Eric J. Mackay</i>	
<b>Iron Sulphide Inhibition and Interaction with Zinc and Lead Sulphide</b> .....	310
<i>B. G. Al-Harbi, A. J. Graham, K. S. Sorbie</i>	
<b>Management of Scale Control in Produced Water Reinjection - The Near Wellbore Scale Challenge Overcome</b> .....	329
<i>M. M. Jordan</i>	
<b>Mechanisms and Mitigation Strategies of Iron Sulfide Deposition in Sour Gas Wells</b> .....	350
<i>Tao Chen, Qiwei Wang, Frank Chang</i>	
<b>New Generation Squeezable Sulfide Inhibitor Successfully Averts Challenging Sulfide Scale Deposition in Permian Basin</b> .....	361
<i>Cyril Okocha, Anton Kaiser, Shane Underwood, Walter Samaniego, Jonathan Wylde</i>	
<b>New Test Method for Scale Inhibitor Qualification Verified by Field Testing</b> .....	375
<i>A. M. K. Halvorsen, K. Reiersølmoen, K. S. Andersen, A. M. Brurås, A. Sylte, Ø Birketveit, R. Evjenth, M. H. Du Plessis</i>	
<b>Non-Chemical Methods for Downhole Control of Carbonate and Sulphate Scales - An Alternative Approach to Scale Management?</b> .....	393
<i>Stephen Heath, Mohd Zahirin Bin Ruslan, Eric McKay, Oleg Ishkov</i>	
<b>A Novel Evaluation of Scale Inhibitor Performance against Calcium Carbonate Scaling in the Presence of Iron Sulfide</b> .....	409
<i>Jeffrey Russek, Nicole Flores, Johnathon Brooks</i>	
<b>Novel Laboratory Test Method and Field Applications for Silica/Silicate and Other Problematic Scale Control</b> .....	421
<i>Haiping Lu, Johnathon Brooks, Rick Legan, Steven Fritz</i>	
<b>A Novel Solution to Remove Carbonate and Sulfate Scale in Electric Submersible Pumps, Offshore Oil Wells in the Gulf of Mexico</b> .....	437
<i>G. Garcia-Olvera, O. Galicia-Lopez, R. Padilla-Martinez, E. Hernandez-DelAngel, A. Salazar-Munive, E. Miquilena-Rojas, M. Muñoz-Rivera, E. Santillán-Mirsaydi</i>	
<b>A Novel View of Barium Sulfate Deposition in Stainless Steel Tubing</b> .....	455
<i>Alex Yi-Tsung Lu, Gedeng Ruan, Khadouja Harouaka, Dushanee Sriyathne, Wei Li, Guannan Deng, Yue Zhao, Xing Wang, Amy Kan, Mason Tomson</i>	
<b>Optimization of Scale Treatment Program for Offshore Field Operations with Presence of Iron</b> .....	464
<i>Dong Joon Lee, Piyush Srivastava, Paul Stead, Johnathon Brooks</i>	
<b>Phosphonate Speciation - Challenges and Solutions</b> .....	487
<i>Sarah J. Ewing, Nicole Hunter, Kirsty MacKinnon, Kelly Whittingham, Gordon M. Graham, Stephen Heath</i>	
<b>The Procedures that Time Forgot: Sample Preservation, Back to Basics</b> .....	501
<i>C. J. Johnston, M. M. Jordan</i>	
<b>Reactive Transport Modelling of a Carbonate Reservoir under Seawater Injection</b> .....	518
<i>Yisheng Hu, Eric Mackay</i>	
<b>Recent Advances in Scale Prediction, Approach, and Limitations</b> .....	542
<i>Amy T. Kan, Joey Zhaoyi Dai, Guannan Deng, Gedeng Ruan, Wei Li, Khadouja Harouaka, Yi-Tsung Lu, Xin Wang, Yue Zhao, Mason B. Tomson</i>	
<b>Recent Experience in Squeeze Treating Huff and Puff Wells for Control of Steamflood Generated Calcium Carbonate Scale</b> .....	559
<i>Alex Thornton, Yaz Belhimer, Ian Smith, Aravind Subramaniyan</i>	
<b>Rigorous Carbonate and Sulphide Scale Predictions: What Really Matters?</b> .....	577
<i>G. Ness, K. S. Sorbie</i>	
<b>Scale Deposition and Hydrodynamics - Benchtop to Pilot Rig</b> .....	595
<i>Neil Goodwin, Mark May, David Nichols, Gordon Graham</i>	
<b>Scale Formation and Inhibition Study for Water Injection Wells</b> .....	610
<i>Wei Wang, Wei Wei, Neil Ferrier, Nayi Arismendi</i>	
<b>Scale Management in Monoethylene Glycol MEG Systems - A Review</b> .....	620
<i>Marion Seiersten, Shiv Shankar Kundu</i>	
<b>Scale Risk Assessment and Novel Coating for Smart Completion: Scale Simulation and CFD Modelling Approach</b> .....	630
<i>Hua Guan, Reda Bouamra, Thomas Lindvig, Jean-Claude Vernus</i>	

<b>Sea Water Desulphation – Optimisation of Scale Treatment and Reduction of OPEX &amp; CAPEX</b> .....	644
<i>S. Baraka-Lokmane, N. Lesage, A. Fayed, M. Jungas, S. Heng, M. Jacob, P. Pedenaud</i>	
<b>Simulating Squeeze Treatments in Wells Completed with Inflow Control Devices</b> .....	661
<i>Amarpreet Kaur, Robert Stalker, Gordon M. Graham</i>	
<b>Simulation of Squeeze Treatment/Tracer Programme Designs</b> .....	671
<i>Oscar Vazquez, Ilias Giannakouras, Eric Mackay</i>	
<b>Simulation Study for Scale Management During Shale Gas Production</b> .....	684
<i>Xu Wang, Eric J. Mackay</i>	
<b>Study of Carbonatic Scale in Completion Tools Through Modeling and Simulation Techniques</b> .....	704
<i>R. S. Maciel, F. S. Maciel, F. A. R. Pereira, D. C. Ribeiro, W. Aldeia, A. L. Martins, M. Bloch, M. V. D. Ferreira</i>	
<b>Unconventional Horizontal Scale Squeezes: Lessons Learned Drive Continued Development and Improved Cost Savings</b> .....	721
<i>L. M. Holding Eagle, K. J. Spicka, J. Fidoe, M. M. Jordan</i>	
<b>Author Index</b>	