

# **6th International Conference on Accelerated Carbonation for Environmental and Material Engineering (ACEME 2018)**

Newcastle, Australia  
11 - 14 March 2018

ISBN: 978-1-5108-7281-3

**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 AIChE  
All rights reserved.

Printed by Curran Associates, Inc. (2018)

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: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

<b>Design of a Hybrid Leaching Process for Mineral Carbonation of Magnesium Silicates: Learnings and Issues Raised from Combined Experimental and Geochemical Modelling Approaches</b> .....	1
<i>Carine Julcour, Florent Bourgeois, Laurent Cassayre, Julien Leclaire, Solène Touzé, Martin Cyr, France Bailly</i>	
<b>Kinetic Study on Accelerated Mineral Carbonation Curing of Cement-Based Materials</b> .....	25
<i>Hao Huang, Tao Wang, Mengxiang Fang, Xutao Hu</i>	
<b>Accelerated Carbonation of Stainless Steel Slag Compacts at Low pCO<sub>2</sub> Pressure – Microstructure and Strength Development As a Function of Temperature and CO<sub>2</sub> Content</b> .....	35
<i>Peter Nielsen, Liesbeth Horckmans, Mieke Quaghebeur, Ruben Snellings</i>	
<b><sup>29</sup>Si Solid State MAS NMR Study on the Fate of Silicon in Mineral Carbonation of Serpentine: A Journey from Mining to End Products</b> .....	45
<i>Emad Benhelal, Muhammad Imran Rashid, James Hook, Mark S Rayson, Geoffrey F Brent, Michael Stockenhuber, Eric M. Kennedy</i>	
<b>Dissolution Mechanism of Serpentine and the Re-Precipitation of Silica Under Constant pH Conditions</b> .....	55
<i>Faezeh Farhang, Mark S Rayson, Geoffrey F Brent, Michael Stockenhuber, Eric M. Kennedy</i>	
<b>Kinetic Modelling of CO<sub>2</sub> Degassing from Magnesium Bicarbonate Solutions and Resultant Precipitation</b> .....	65
<i>Timothy K. Oliver, Bogdan Z. Dlugogorski, Eric M. Kennedy</i>	
<b>Carbonate Microbialites</b> .....	77
<i>Gordon Southam, Gregory Webb, Luke Nothdurft, David J. Paterson, Jenine McCutcheon, Robert Burne, Nicole Irazabal</i>	
<b>Accelerated Carbonation and Granulation for Treatment of Mine Tailings Using MgO/GGBS Binder</b> .....	95
<i>Tae Yoo Kim, Inseong Hwang, Jun-Young Ahn, Su-Jin Choi</i>	
<b>An Acid Recovery and Mineral Carbonation Process for the Nickel Industry</b> .....	96
<i>Lauren Zappala, Reydick Balucan, Karen Steel, James Vaughan</i>	
<b>Carbon Capture, Utilization and Storage (CCUS) Via Innovative Mineralization Pathways</b> .....	104
<i>Guanhe Rim, Mark Rayson, Geoffrey F Brent, Donghyun Lee, Ah-Hyung Alissa Park</i>	
<b>The Utilisation of Victorian Brown Coal Fly Ash in Mineral Carbonation</b> .....	128
<i>Tahereh Hosseini, Lian Zhang</i>	
<b>Mineral Carbonation Curing of Wollastonite-Blends Paste: Feasibility of Low Lime Calcium Silicate</b> .....	136
<i>Hao Huang, Ruonan Guo, Tao Wang, Mengxiang Fang</i>	
<b>Mg-Isotope Signatures for Tracing of Natural Carbonation Reactions</b> .....	137
<i>Hans C. Oskierski, Vasileios Mavromatis, Andreas Beinlich, Mohammednoor Altarawneh, Bogdan Z. Dlugogorski</i>	
<b>Greener Pervious Concrete Incorporating Surface Modified Activated Carbon</b> .....	149
<i>Heba Hamad</i>	
<b>Dissolution of Heat Activated Lizardite for Direct Aqueous Carbonation at Elevated Pressures and at Low Temperatures</b> .....	158
<i>Ammar Abu Fara, Mark S Rayson, Geoffrey F Brent, Michael Stockenhuber, Eric M. Kennedy</i>	
<b>Integrating MEA-based CO<sub>2</sub> Absorption and Fly Ash-based Amine Regeneration for Energy-efficient CO<sub>2</sub> Sequestration from Flue Gas</b> .....	170
<i>Long Ji</i>	
<b>Mineralogical Study of Thermally Activated Serpentine Dissolution Process for Direct Flue Gas CO<sub>2</sub> Abatement By Mineral Carbonation</b> .....	182
<i>Louis Cesar Pasquier, Clémence Du Breuil, Guy Mercier, Gregory M. Dipple, Bart De Baere, Kate Carrol, Jean-François Blais, Maria C. Iliuta</i>	
<b>Metal Mobility during Passive and Accelerated Carbonation of Ultramafic Mineral Wastes</b> .....	183
<i>Siobhan A. Wilson, Jessica L. Hamilton, Bree Morgan, Connor C. Turvey, Jenine McCutcheon, David J. Paterson, Alastair W. Tait, Gordon Southam</i>	
<b>Reducing of CO<sub>2</sub> and H<sub>2</sub>S for Biogas Upgrading Using Accelerated Mineralization</b> .....	185
<i>Bastian Alexander Sakowski</i>	
<b>Carbonation Kinetics of Waste Concrete</b> .....	194
<i>Subrahmaniam Hariharan, Marco Mazzotti, Johannes Tiefenthaler</i>	
<b>Integrated Carbon Mineralization and Air Pollutant Emission Reduction Via a High-Gravity Process Using Alkaline Wastes</b> .....	202
<i>Tse Lun Chen, Yun Ke Fan, Si Lu Pei, Shu Yuan Pan, Yi Hung Chen, Pen Chi Chiang</i>	
<b>Utilization of Industrial Wastes and CO<sub>2</sub> in Construction Materials - An Estonian Perspective</b> .....	221
<i>Kadriann Tamm, Mai Uibu, Rein Kuusik, Colin D Hills, Hakan Berber, Paula Carey</i>	

<b>Analysis of the Effects of Slurry Phase Carbonation on the Leaching Behaviour of Different Types of Waste Incineration Bottom Ash .....</b>	<b>231</b>
<i>Giulia Costa, Francesco Lombardi, Alessandra Poletti, Raffaella Pomi, Riccardo Spagnuolo</i>	
<b>Factors Controlling the Dissolution of Thermally Activated Serpentine Under High Pressure and Temperature Carbonic Acid .....</b>	<b>239</b>
<i>Jason P. Mann, Brian S. Haynes</i>	
<b>Past, Present &amp; Future - Green Minerals .....</b>	<b>248</b>
<i>Pol Knops</i>	
<b>Serpentine Carbonation Using the Åbo Akademi Routes – Status Update .....</b>	<b>254</b>
<i>Ron Zevenhoven, Martin Slotte, Evelina Koivisto, Rickard Erlund</i>	
<b>Manufactured Carbonated Aggregates: Update .....</b>	<b>N/A</b>
<i>Colin D Hills</i>	
<b>Factors Affecting the Formation of Magnesite and Hydromagnesite from Direct Aqueous Carbonation of Thermally Activated Lizardite .....</b>	<b>265</b>
<i>Ammar Abu Fara, Mark S Rayson, Geoffrey F Brent, Michael Stockenhuber, Eric M. Kennedy</i>	
<b>Development of Grinding Media for Aqueous Mineral Carbonation Applications .....</b>	<b>279</b>
<i>Muhammad Imran Rashid, Emad Benhelal, Leo Anderberg, Faezeh Farhang, Timothy K. Oliver, Mark S Rayson, Geoffrey F Brent, Michael Stockenhuber, Eric M. Kennedy</i>	
<b>Exploring the Metastability Field for Precipitates Formed from Degassed Serpentine Leachate .....</b>	<b>295</b>
<i>Timothy K. Oliver, Todd W. Hodgins, Mark S Rayson, Geoffrey F Brent, Michael Stockenhuber, Eric M. Kennedy</i>	
<b>The Potential of Carbon Storage in the Ocean as Bicarbonate .....</b>	<b>306</b>
<i>Phil Renforth</i>	
<b>Scrubbing CO<sub>2</sub> from a Simulated Flue Gas via the Dissolution of Heat-Activated Serpentine .....</b>	<b>326</b>
<i>Todd W. Hodgins, Timothy K. Oliver, Faezeh Farhang, Mark S Rayson, Geoffrey F Brent, Geoffrey M. Evans, Michael Stockenhuber, Eric M. Kennedy</i>	
<b>Augmenting the Magnesite Yield Produced During Aqueous Mineral Carbonation of Dunite Rock .....</b>	<b>343</b>
<i>Muhammad Imran Rashid, Emad Benhelal, Faezeh Farhang, Omid Mowla, Mark S Rayson, Geoffrey F Brent, Michael Stockenhuber, Eric M. Kennedy</i>	
<b>Dynamic CO<sub>2</sub> Sequestration in an Industrial-Scale Chrysotile Mining Waste Pile .....</b>	<b>357</b>
<i>Georges Beaudoin, Ali Nowamooz, F. Larachi, Christian Dupuis, John W.H. Molson, Jean-Michel Lemieux, Michal Horswill, Richard Fortier, Xavier Maldague, Marc Constantin, Josée Duchesne, René Therrien</i>	
<b>Chemical and Crystallographic Controls on Wollastonite Carbonation .....</b>	<b>359</b>
<i>Carlos Rodriguez-Navarro, Encarnacion Ruiz-Agudo, Fulvio di Lorenzo, Luis Monasterio-Guillot</i>	
<b>Accelerated Mineral Carbonation Technology for Land Reclamation: A Bridge to Link Mitigation and Adaptation Actions .....</b>	<b>367</b>
<i>Jie Bu, Tze Yuen Yeo, Paul Sharratt</i>	
<b>Scale up of the Wet Route Carbonation of Steel Slag in a Rotary Kiln Pilot-Scale Reactor .....</b>	<b>369</b>
<i>Renato Baciocchi, Giulia Costa, Stefano Stendardo, Paola Librandi</i>	
<b>Isoconventional Kinetic Modelling and In-Situ Synchrotron Powder X-Ray diffraction analysis for Dehydroxylation of Antigorite .....</b>	<b>378</b>
<i>Sana Zahid, Hans C. Oskierski, Gamini Senanayake, Mohammednoor Altarawneh, Fang Xia, Helen E. A. Brand, Ibukun Oluwoye, Bogdan Z. Dlugogorski</i>	
<b>Economic Studies of Carbonation Processes, Turning Feasibility into Reality .....</b>	<b>390</b>
<i>Louis Cesar Pasquier, Nassima Kemache, Jean-François Blais, Sandra Kentish, Guy Mercier</i>	
<b>Carbon Mineralization as One of the Main CO<sub>2</sub> Utilization Strategies - Report on the Mission Innovation CCUS Experts' Workshop .....</b>	<b>391</b>
<i>Giulia Costa</i>	
<b>Improving Energy Efficiency of the In-situ Mineral Carbonation Process Using Pinch Analysis .....</b>	<b>407</b>
<i>Ilies Tebbiche, Louis Cesar Pasquier, Guy Mercier, Jean-François Blais, Sandra Kentish</i>	
<b>Study of the Potential of Carbonated Solid Foams As Acoustic Insulation Instead Using Sustainable Blowing Agents .....</b>	<b>408</b>
<i>Oscar Duque, Leidy Garcia, Nathalya Bolivar, Soed Rodriguez, Angela Garcia, Mónica Amado</i>	
<b>Synthesis and Characterisation of Reactive Silica Residues from Mineral Carbonation Process .....</b>	<b>426</b>
<i>Emad Benhelal, Muhammad Imran Rashid, Mark S Rayson, Geoffrey F Brent, Michael Stockenhuber, Eric M. Kennedy</i>	
<b>Influence of Mineralogy and Process Parameters on Microstructure Development and Mechanical Properties of Carbonated Compacts .....</b>	<b>435</b>
<i>Renato Baciocchi, Giulia Costa, Paola Librandi, Peter Nielsen, Mieke Quaghebeur, Ruben Snellings</i>	
<b>Accelerated Carbon Mineralization in MINE Tailings .....</b>	<b>445</b>
<i>Gregory M. Dipple, Ian M. Power, Kate Carrol, Bart De Baere, Sterling Vanderzee</i>	
<b>Effect of Accelerated Carbonation on the Performance of MgO-Based Binder .....</b>	<b>446</b>
<i>Jun-Young Ahn, Tae Yoo Kim, Inseong Hwang, Do Youn Yun</i>	

**Making Biogas a CO2 Sink Using Carbon Mineralization** ..... 447

*Bastian Alexander Sakowski*

**Author Index**