

# **Bio- and Hydrometallurgy 2010**

**(BioHydromet 10)**

**Cape Town, South Africa**

**8-9 November 2010**

ISBN: 978-1-61782-349-7

**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.**

All papers Copyright© 2010 by the respective author(s), and included in these proceedings by permission to the Minerals Engineering International.  
All rights reserved.

Printed by Curran Associates, Inc. (2011)

For permission requests, please contact the author(s) of the paper desired.

**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

## TECHNICAL SESSION 1

<b>Bioleaching of Six Nickel Sulphide Ores with Differing Mineralogies in Stirred-tank Reactors at 30°C</b> .....	1
<i>Rory A. Cameron, Rolando Lastra, W. Douglas Gould, Saviz Mortazavi, Yves Thibault, Pierre L. Bedard, Lucie Morin, David W. Koren, Kevin J. Kennedy</i>	
<b>Bioleaching and Recovery of Metals from Final Slag Waste of the Copper Smelting Industry</b> .....	28
<i>Anna H. Kaksonen, Leena Lavonen, Mari Kuusenaho, Anni Kolli, Heli Narhi, Elina Vestola, Jaakko A. Puhakka, Olli H. Tuovinen</i>	
<b>The Generation of Toxic Reactive Oxygen Species (ROS) from Mechanically Activated Sulfide Concentrates and the Effect on Thermophilic Bioleaching</b> .....	58
<i>Gavin C. Jones, Kirsten C. Corin, Robert P. Van Hille, Susan T. L. Harrison</i>	
<b>The Efficiency of Indigenous and Designed Consortia in Bioleaching Stirred Tank Reactors</b> .....	79
<i>C. G. Bryan, C. Joulain, P. Spolaore, S. Challan-Belval, H. El Achbouni, D. Morin, P. D'Hugues</i>	
<b>Bioleaching Strategies for the Treatment of Nickel-copper Sulfide Concentrates</b> .....	102
<i>Mariekie Gericke, Yageshmi Govender</i>	
<b>Respirometry Studies of Bioleaching 1 of Low Grade 2 Chalcopyrite Ore Using Six Acidophilic Strains</b> .....	126
<i>Jian Song, Peter D. Franzmann, Jianqiang Lin, Jianqun Lin, Anna H. Kaksonen</i>	
<b>Non-traditional Operating Conditions for a Copper Concentrate Continuous Bioleaching</b> .....	156
<i>P. Spolaore, C. Joulain, Y. Menard, P. D'Hugues</i>	
<b>Fluoride Ion Effects on the Kinetics of Ferrous Iron Oxidation by <i>Sulfobacillus Thermosulfidooxidans</i></b> .....	175
<i>Lazaro Chaves Sicupira, Tacia Costa Veloso, Isabel Cristina Braga Rodrigues, Victor Alvarenga Oliveira, Versiane Albis Leao</i>	

## TECHNICAL SESSION 2

<b>Inhibition of the Bioleaching Microorganism <i>Acidithiobacillus Thiooxidans</i> by SDS Addition</b> .....	191
<i>Hans-Michael Siebert, Robert Marmulla, K.-Peter Stahmann</i>	
<b>Laboratory Simulation and Optimisation of Stope Leaching of Low-grade Uranium Ore</b> .....	202
<i>D. J. Sapsford, K. M. Penman, R. J. Bowell, M. Dey</i>	
<b>Large Particle Effects in Chemical/biochemical Heap Leach Processes - A Review</b> .....	213
<i>Yousef Ghorbani, Jochen Petersen, Megan Becker, Aubrey Mainza, Jean-Paul Franzidis</i>	
<b>Performance Evaluation of the Skorpion Zinc Pinned Bed Clarifiers</b> .....	242
<i>S. Dowling, H. Fuls, M. Langton</i>	
<b>Gas Phase Metal Extraction Case Study: The Extraction of Iron from Iron(III) Oxide</b> .....	266
<i>L. D. Van Dyk, E. Mariba, Y. Cheng, J. H. Potgieter</i>	

## TECHNOCAL SESSION 3

<b>High Pressure Acid Leaching of a Turkish Laterite Ore</b> .....	276
<i>Serif Kaya, Yavuz A. Topkaya</i>	
<b>Interaction of Microorganisms in a Hematite-Quartz Flotation System</b> .....	297
<i>Nagui A. Abdel-Khalek, Hanumantha Rao, Khaled E. Yassin, Samah S. Abdallah, Khaled A. Selim, Abdel-Hakim Kandel</i>	
<b>Extracellular Polymeric Substances (EPS) from Bioleaching Systems and Its Application in Bioflotation</b> .....	310
<i>Yageshmi Govender, Mariekie Gericke</i>	
<b>Control of Bacterial Metal Sulfide Leaching Processes</b> .....	336
<i>B. Florian, N. Noel, C. Thyssen, I. Felschau, W. Sand</i>	
<b>The Effect of Temperature on the Attachment of <i>Metallosphaera hakonensis</i> to a Copper Sulphide Concentrate with Application to Heap Bioleaching</b> .....	353
<i>L. Bromfield, C. J. Africa, S. T. L. Harrison, R. P. Van Hille</i>	
<b>Bioleaching of Gold and Copper from Waste Mobile Phone PCBs by Using a Cyanogenic Bacterium</b> .....	376
<i>Tran D. Chi, Jai-Chun Lee, B. D. Pandey, Kyoungkeun Yoo, Jinki Jeong</i>	

<b>Bioleaching of Printed Circuit Board by Acidithiobacillus Ferrooxidans</b> .....	384
<i>L. H. Yamane, D. C. R. Espinosa, J. A. S. Tenorio</i>	

#### **TECHNICAL SESSION 4**

<b>The Aster Process : Technology Development Through to Piloting, Demonstration and Commercialization</b> .....	393
<i>Nobuzwe Makhotla, Craig Van Buuren, Johan Waldemar Olivier</i>	
<b>Sequential Precipitation of Cu and Fe Using a Three-stage Sulfidogenic Fluidized-bed Reactor System</b> .....	412
<i>Deniz Ucar, Ozan K. Bekmezci, Anna H. Kaksonen, Erkan Sahinkaya</i>	
<b>Bioprocessing of Coal Tailings for the Production of the Coagulant Ferric Sulphate</b> .....	430
<i>Angeli Viviani Colling, Jean Carlo Salome Dos Santos Menezes, Ivo Andre H. Schneider</i>	
<b>Kinetics of Uranium(VI) Reduction in an Indigenous Culture of Mine Soil Bacteria</b> .....	438
<i>Simphiwe Chabalala, Evans M. N. Chirwa</i>	
<b>Biosorption of Yttrium, Lanthanum, Cerium, and Neodymium from Apatite Leaching Aqueous Solution Using Platanus Orientalis Leaf Powder</b> .....	453
<i>E. Jorjani, Sh. Amirshahi</i>	
<b>Molecular Characterisation of the Microbial Community of a Full-scale Bioreactor Treating Bayer Liquor Organic Waste</b> .....	468
<i>N. J. McSweeney, A. L. Tilbury, H. J. Nyeboer, A. J. McKinnon, D. C. Sutton, P. D. Franzmann</i>	

#### **POSTERS**

<b>Adaptation of Acidithiobacillus Ferrooxidans LR to Printed Circuit Board from Scrap Computer</b> .....	492
<i>L. H. Yamane, D. C. R. Espinosa, J. A. S. Tenorio</i>	
<b>Hydrometallurgical Reclamation of Cu, Ag and Sn from Waste Pb-free Solder Using Nitric Acid</b> .....	500
<i>Kyoungkeun Yoo, Jae-Chun Lee, Eun-Young Kim, Soo-Kyoung Kim, Jinki Jeong</i>	
<b>Biohydrometallurgical Production of Heptahydrate Iron Sulphate Crystals from the Pyrite Present in Coal Tailings</b> .....	507
<i>Eunice M. Viganico, Angeli Viviane Colling, Rodrigo De Almeida Silva, Ivo Andre H. Schneider</i>	
<b>Finite Difference Simulation of Biological Cr(VI) Removal in Aquifer Microcosm Reactors</b> .....	514
<i>Phalazane J. Mtimunye, Zinzi M. Mboweni, Evans M. N. Chirwa</i>	
<b>Biosorption of Heavy Metals by Algae Communities in Water Streams Impacted by the Acid Mine Drainage in the Coal Mining Region of Santa Catarina - Brazil</b> .....	526
<i>Ana Paula Pires Freitas, Ivo Andre Homrich Schneider, Albano Schwartzbold</i>	
<b>Thermodynamic Modelling of Concentrated Sulphuric Acid Solutions</b> .....	533
<i>Hannu Sippola</i>	
<b>The Conversion of Celestite to Srco<sub>3</sub> in Ammoniacal Solution Containing Ammonium Carbonate/bicarbonate</b> .....	547
<i>Mert Zoraga, Cem Kahruman</i>	
<b>Investigating Microbial Colonisation in Bioheaps with Varying Irrigation Rate</b> .....	561
<i>R. Chiume, S. Minnaar, E. Ngoma, C. Bryan, S. T. L. Harrison</i>	
<b>Bio-desorption of Lithium Isotope (<sup>7</sup>Li<sup>+</sup>) from a 1 Degraded Lithiated 2 Mixed-bed Ion-exchange Resin Using Acidithiobacillus Caldus</b> .....	580
<i>M. Basitere, S. K. O. Ntwampe, M. S. Sheldon</i>	
<b>Separation of Zirconium and Hafnium using Electrical Field</b> .....	597
<i>Ascar Sadigzadeh, Hamed Shokri, Seyed Hadi Tabaian</i>	
<b>Author Index</b>	