9th International Symposium on Hydrometallurgy 2023

Phoenix, Arizona, USA 27 - 30 August 2023

ISBN: 978-1-7138-9354-7

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.

Copyright© (2023) by Society for Mining, Metallurgy and Exploration (SME) All rights reserved.

Printed with permission by Curran Associates, Inc. (2024)

For permission requests, please contact Society for Mining, Metallurgy and Exploration at the address below.

Society for Mining, Metallurgy and Exploration Inc. 12999 East Adam Aircraft Circle Englewood, CO 80112-4167

Phone: (303) 948-4200 Fax: (303) 973-3845

cs@smenet.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 Web: www.proceedings.com

Contents

Environment/Waste Treatment

Assessing the Suitability of Mine Tailings as a Geopolymer Precursor Material for Subsurface Engineered Barriers during In-Situ Recovery Operations...1

Godfrey Mawire, Robbie McDonald, Lionel Esteban, Abhijit Mukherjee, Navdeep Dhami

Sustainable Water Recovery from Hydrometallurgical Effluents Using Gas Hydrate Based Desalination...17

Seyed Mohammad Montazeri, Georgios Kolliopoulos

In Pursuit of Zero Discharge: Forward Osmosis and Freeze Concentration for Hydrometallurgical Wastewater Recycling...27

Noel Devaere, Vladimiros G. Papangelakis

Materials for Clean Energy

The Atlas Materials Process for Carbon Negative Nickel and Cobalt Recovery from Laterites...41

David Dreisinger, Jeremy Ley, Mike Johnson, Niels Verbaan, Sridevi Thomas

Metal Extraction

Atmospheric Tank Leaching of Chalcopyrite Concentrate in Ferric Sulfate Media...58
Reza Kurniawan, Wenying Liu, and David Dreisinger

Use of Activated Carbon as Copper Substitutes During Cobalt Cementation for Zinc Electrolyte Purification...68

Hanggoo Kim, Dakyeong Baek, Yoojin Lima, Kyoungkeun Yoo

Evaluating the Use of a Dynamic Model to Predict Direct Copper Electrowinning Tankhouse Performance...72

Suné Grobbelaar, Christie Dorfling, Margreth Tadie

Precious Metals Refinery Transformation—Piloting as a Basis for Success...86 Christoph Ziegler, Leslie Bryson

Optimisation of Silver Electrorefining at Aurubis...97

Leslie Bryson, Christoph Ziegler

Improving the Rate of Recovery from Copper Leach Residue with the Addition of a Wetting Aid: A Metallurgical and Geophysical Study...109

M.L. Catling, R.G. Copp, J.J. Taute, D.F. Rucker, B.D. Cubbage

Performance Evaluation of Modified Biopolymers as Acid Suppressants in Copper Electrowinning...122

Marcio Ribeiro, Peter So, Patrick Wong

Leaching Metals from Phyllosilicate Ores...131

Isabel Barton, Maxwell Drexler, Molly Radwany, Pierre Marie Zanetta

High Performance Liquid Chromatography Analytical Method Development for Reduced Sulfur Species Quantification in Cyanide Leach Solutions...140

N. Duru, C. Nesbitt

Ammonium Thiosulfate Leaching of Gold with Magnesium Hydroxide and Its Effect on the Consumption of Thiosulfate...154

Sujin Chae, Farzaneh Sadri, Yeonuk Choi, Ahmad Ghahreman

Extraction of Critical Elements from Sulfuric Acid Solutions...165

Weston C Hartzell, Michael S Moats

Stabilization of Arsenic Byproduct from Decopperization Process to Scorodite Using Methanesulfonic Acid...175

Junmo Ahn, Jiajia Wu, Jaewoo Ahn, Jaeheon Lee

Microbial Pretreatment of Preg-Robbing Carlin-Type Carbonaceous Ore...185

Anthony Kaah

Suppression of Ammonium Thiosulfate Gold Leaching in the Presence of Arsenopyrite and a Pretreatment to Improve Gold Extraction...195

Takunda Joseph Mhandu, Sohta Hamatsu, Sanghee Jeon, Ilhwan Park, Yogarajah Elakneswaran, Mayumi Ito, Naoki Hiroyoshi

Copper Extraction from Chalcopyrite in Various Hydrometallurgical Systems...203

Jaeyeon Kim, Junmo Ahn, Jaeheon Lee

Agglomeration Scale: A Method to Improve Leaching Performance...217

Amado Guzman, Sara Swiokla Korsikas, Toren Olson, Yuri O. Zepeda P.

Kupferglimmer—Its Identification and Leaching in Copper Anode Slimes...240

Shijie Wang

Plant Practices

Reverse Osmosis Treatment of In-situ Copper Leach Solution...247

Lingyu Zhang

Comprehensive Analysis of Cathode Stripping Behavior: Simulation by the Finite Element Method and Experimental Results...257

N.G.S Almeida, V.S.T Ciminelli, D. Majuste, P.R.Cetlin

Rare Earth/Critical Minerals

Temperature Dependence of Biooxidation of Coal-Based Pyrite...271

Kitsel Lusted, Prasenjit Podder, Joel Ilunga, Kara Sorenson, Prashant Sarswat, Michael Free

Hydrometallurgical Treatment of Copper Flash Smelter Dusts via Ammoniacal Leaching...285 Joseph Trouba, Corby Anderson

Sequential Leaching of Nevada Sedimentary Claystones for Subsequent Selective Lithium Extraction...293

Angela Tita, Pengbo Chu

Intra-Lanthanide Separation Processes Using Neutral Diglycolamide Extractants...304

Kevin L. Lyon, Santa Jansone-Popova, Derek M. Brigham, Mitchell R. Greenhalgh, Amy K. Welty, Melissa M. Warner, Bruce A. Moyer

Enhancing the Recovery of Rare Earths and Phosphate Enriched By-Product from Monazite Ore via Sulfuric Acid Baking with Additives...313

Tarek Mohammed, Andro Tomas, Gamini Senanayake, Wensheng Zhang

Fluoride-free Processing of Columbite Concentrate for Selective Recovery of Niobium and Tantalum Oxides...323

Himanshu Tanvar, Brajendra Mishra

Fluoride Control and Flowsheet Development for the Hydrometallurgical Processing of Bastnaesite Concentrates...334

Austin Rich, Corby Anderson, Brock O'Kelley

Use of Hydrogen Peroxide to Inhibit Silicon Co-Extraction with Iron during Slag Leaching...361 Michael Caplan, Corby Anderson, Erik Spiller, Roberto Huamani

Separation of Rare Earth Elements Using Electrodialysis...376

Gisele Azimi, Lingyang Ding

Recovery/Recycling

Palladium Pressure Leaching Kinetics in Chloride medium, from Printed Circuit Boards, in a Pressure Reactor...384

Guadalupe Martínez-Ballesteros, Jesús Leobardo Valenzuela-García, Patricia Guerrero-Germán, María Mercedes Salazar-Campoy, Agustín Gómez-Alvarez

Recycling of Bauxite Residue (red mud) for Recovery of Metallic Values...397

Himanshu Tanvar, Brajendra Mishra

Potential of Total Recycling Valuable Materials from Light-Emitting Diodes Module by Pre-Treatment Using Heating and Resin Decomposition...410

Seunghyun Kim, Ha Bich Trinh, Taehun Son, Jaeryeong Lee

Recovery of Valuable Metals from LIBs Black Mass by Nickel Pre-Loaded Extractants...417 Yeon Chul Cho, Ki Hun Kim, Junmo Ahn, Jaewoo Ahn

Infrared Assisted Dissolution as a New Solubilization Method for Critical Metals in Different E-Waste Streams...423

Mélodie Bonin, Frédéric-Georges Fontaine, Dominic Larivière

Solvometallurgical Recycling of Lithium-ion Battery Components...435

Halimeh Askari Sabzkoohi, Georgios Kolliopoulos

A Sustainable Method to Recover the Critical Metals from Spent Lithium-Ion Batteries by Glycine and Sodium Metabisulfite in a Near-Neutral Solution...442

Jiajia Wu, Jaeheon Lee

Separation Technologies

On The Feasibility of Forward Osmosis and Freeze Concentration: A Process Simulation and Cost Analysis...448

Runlin Yuan, Vladimiros G. Papangelakis

Rare Earth Elements Separation Principles and Methods...460

Michael L. Free, Prashant K. Sarswat

Copper Refinery and Impurity Control...472

Bradford C. Wesstrom