Society for Mining, Metallurgy, and Exploration, Inc.

Transactions Volume 334

Transactions of the Society for Mining, Metallurgy, and Exploration, Inc.

Volume 334 2013

Editors:

Emily Wortman-Wunder

ISBN: 978-1-62993-853-0

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© (2013) by the Society for Mining, Metallurgy & Exploration All rights reserved.

Printed by Curran Associates, Inc. (2014)

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

Society for Mining, Metallurgy & Exploration 8307 Shaffer Parkway Littleton, Colorado 80127-4102

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: 845-758-2634

Email: curran@proceedings.com Web: www.proceedings.com

Volume 334 Transactions of the Society for Mining, Metallurgy and Exploration, Inc.

Volume 334 contains three sections of technical papers:

- Section 1: Includes all papers published in the Technical Papers Section of *Mining Engineering* in 2013, Vol. 65, including the January through April, June, July and August, and October through December issues (no technical papers were published in the May or September issues). *Mining Engineering* papers are identified as "*Mining Engineering*, Vol. 65" in the index.
- Section 2: Includes all papers published in the February, May, August and November 2013 issues of Minerals & Metallurgical Processing, Vol. 30, Nos. 1, 2, 3 and 4. Minerals & Metallurgical Processing papers are identified as "Minerals & Metallurgical Processing, Vol. 30" in the index.
- Section 3: This section includes papers published only in this volume. Transactions papers are identified as "Transactions, Vol. 334" in the index.

CONTENTS

SECTION 1: MINING ENGINEERING MAGAZINE TECHNICAL PAPERS

This section contains all papers published in Mining Engineering during 2013, Vol. 65

JANUARY

Theory and practice of fully mechanized longwall mining in steeply dipping coal seams Y. Wu, P. Xie, H. Wang, D. Yun, S. Ren and X. Chen

1

FEBRUARY

- Discussion: Comments on "Coal workers' pneumoconiosis prevalence disparity between Australia and the United States" 8 *X. Huang, Y. Luo and K. Luxbacher*
- Analyzing solutions of the openpit block sequencing problem obtained via Lagrangian techniques

 W.B. Lambert and A.M. Newman

MARCH

Use of quarry fines to make a construction aggregate S.C. Gaillard, R. Mensah-Biney and J.W. Miller

18

APRIL

Uncertainty-based mine production scheduling for ore grade control using conditional simulation and multiobjective genetic algorithms 26

B. Samanta, K. Vaibhav Raj, A. Battacherjee and D. Chakravarty

MAY

Tube bundle system for monitoring of coal mine atmosphere R. Karl Zipf, Jr., W. Marchewka, K. Mohamed, J. Addis and F. Karnack

37

JUNE

Preparing graduate talent for the mining industry: a new metric system based on an old tradition S. Frimpong, J.M. Whiting and R.S. Suglo	44
AUGUST	
Factors influencing metal price selection in mining feasibility studies J.A. Espí and L. De La Torre	53
Role of gas pressure in underground coal mine bursts and bumps W.G. Pariseau	60
SEPTEMBER	
Impact of face ventilation and nitrogen inertization on hazardous gas distribution in bleederless longwall gobs <i>J. Marts, J. Brune, R. Gilmore, D. Worrall and J. Grubb</i>	69
Helmet-Cam: tool for assessing miners' respirable dust exposure A.B. Cecala, W.R. Reed, G.J. Joy, S.C. Westmoreland and A.D. O'Brien	76
OCTOBER	
NO _x emission of equipment and blasting agents in surface coal mining A. Lashgari, C. Johnson, V. Kecojevic, B. Lusk and J.M. Hoffman	83
Portable instruments for measuring tailpipe diesel particulate in underground mines J. Noll, J. Volkwein, S. Janisko and L. Patts	91
NOVEMBER	
Openpit limit optimization through databases: an open source for data analysis and reporting services <i>R. Benito</i>	99
Determination of volumetric changes from laser scanning at an underground limestone mine B. A. Slaker, E. C. Westman, B. P. Fahrman and M. Luxbacher	105
DECEMBER	
Pilot study on the influence of the eccentric speed on cone crusher production and operation D. Jacobson and N. Lamminmaki	110
Geopolymer-based concrete to reduce carbon footprint of the construction industry H. Akbari, T. Heller, S. Shin, X. Yang, P. Kolay, S. Kumar and M.K. Mohanty	117
Simple method to select a pit in the presence of grade uncertainty T. Elkington and R. Prott	123

SECTION 2: MINERALS & METALLURGICAL PROCESSING

This section contains all papers published in *M&MP* during 2013, Vol. 30

FEBRUARY

Special Issue: Rare earths

Design and development of novel flotation reagents for the beneficiation of Mountain Pass rare-earth ore Pradip and D.W. Fuerstenau	129
Characterization of rare-earth resources at Mountain Pass, CA using high-resolution X-ray microtomography (HRXMT) C.L. Lin, Ching-Hao Hsieh and J.D. Miller	138
Electrophoretic mobility and computations of solid-aqueous solution equilibria for the bastnaesite- H_2O system $R.$ Herrera-Urbina, Pradip and D.W. Fuerstenau	146
Surface chemistry considerations in the flotation of rare-earth and other semisoluble salt minerals <i>X. Zhang, H. Du, X. Wang and J.D. Miller</i>	152
Oxide reduction processes in the preparation of rare-earth metals <i>C.K. Gupta and N. Krishnamurthy</i>	166
Kinetics of leaching zinc and indium from indium-bearing zinc ferrite mechanically activated by tumbling mill <i>J. Yao, X. Li, L. Pan, J. Mo and Z. Wen</i>	173
Separation of rhenium and molybdenum from molybdenite leach liquor by the solvent extraction method <i>A. Khoshnevisan, H. Yoozbashizadeh, M. Mohammadi, A. Abazarpoor and M. Maarefyand</i>	181
Extractive metallurgy of rhenium: a review C.D. Anderson, P.R. Taylor and C.G. Anderson	187
Growth of metallic iron particles during coal-based reduction of a rare earths-bearing iron ore Peng Gao, Yongsheng Sun, Duozhen Ren and Yuexin Han	202
MAY	
Leaching behavior of copper powders from waste printed circuit board by electrogenerated chlorine and aeration <i>P. Zhu, Y. Chen, Y. Hao, Z.Y. Fan, G.R. Qian and M. Zhou</i>	207
Particle size distribution and water recovery under the natural hydrophobic response flotation of printed circuit board comminution fines I.O. Otunniyi, M.K.G. Vermaak and D.R. Groot	213
Selective removal of mercury using zinc sulfide <i>K.L. Gabby and T.C. Eisele</i>	219
Increased carbon dioxide absorption rates in carbonate solutions through surfactant addition B.P. Spigarelli, P.C. Hagadone II and S. Komar Kawatra	223
Effects of sodium carbonate on the carbothermic reduction of siderite ore with high phosphorus content Shaojun Bai, Chao Lv, Shuming Wen, Dianwen Liu, Wenbin Zhang and Qinbo Cao	228
Carbothermic reduction kinetics of ilmenite concentrates catalyzed by sodium chloride and microwave-absorbing characteristics of reductive products Wei Li, Jinhui Peng, Shenghui Guo, Libo Zhang, Guo Chen, Hongying Xia and Bingguo Liu	236
Discovery of a new source of unavoidable ions in pyrite aqueous solutions Yongjun Xian, Shuming Wen, Jian Liu, Jiushuai Deng and Shaojun Bao	245
Concentration of high-sulfur copper ore using a three-product magnetic flotation column Rongdong Deng, Quanjun Liu, Ting Hu and Fenghong Ye	250
Platinum adsorption from chloride media using carbonized biomass and commercial sorbent M.H. Morcali, B. Zeytuncu, S. Aktas, O.Yucel and A.N. Gulluoglu	257

AUGUST

Coarse and fine "fish hook" inflections in hydrocyclone efficiency curves T.C. Eisele, C.H.N. Jeltema, H. Walqui, and S.K. Kawatra	265
DEM-PBM approach to predicting particle size distribution in tumbling mills <i>C.A. Pérez-Alonso and J.A. Delgadillo</i>	273
Fungal leaching of metals from electronic scrap S. Ilyas and Jc. Lee	279
Effect of nanobubbles on the flotation of different sizes of coal particle Maoming Fan, D. Tao, Yuemin Zhao and R. Honaker	285
Two-stage coal flotation to remove pyritic sulfur, arsenic, selenium and mercury <i>E.H. Cho, O. Olajide and R.Y.K. Yang</i>	290
WROC – An improved waste rock oxidation code S. Sunkavalli, J. Kidder, K. Heatwole, D. Shier and A. Davis	297
Investigation of cobalt sulfate precipitation by alcohol and influencing factors S. Aktas, H. Gürcan, A. Keskin, M.H. Morcali, S. Özbey and O. Yücel	302
Improving leaching recovery of copper from low-grade chalcopyrite ores <i>J.M. Ekenes and C.A. Caro</i>	308
Student Poster Contest Results and Selected Abstracts Foreword by Emily Sarver, Virginia Polytechnic Institute & State University, Blacksburg, VA	314
Brett Spigarelli, Michigan Technological University, Houghton, MI Howard Haselhuhn, Michigan Technological University, Houghton, MI Caelen Anderson, Colorado School of Mines, Golden, CO	315 316 318
NOVEMBER	
Effects of tramp grinding steel and iron fines on comminution, flotation and cyanidation <i>H.K. Lin, D.E. Walsh and H. Yen</i>	319
Measurement of weak and dissociable (WAD) cyanide with a modified potentiometric titration <i>M. Botz, E. Milosavljevic and I. Ward</i>	325
Biological sulfate reduction of a sulfate-rich industrial waste liquor using sulfate-reducing bacteria <i>K.A. Natarajan and S. Usha Padukone</i>	333
Formation of hydrogen peroxide by chalcopyrite and its influence on flotation A. Javadi Nooshabadi and K. Hanumantha Rao	340
Validation of tumbling mill charge-induced torque as predicted by simulations <i>P. Jonsén, J.F. Stener, B.I. Pålsson and H-Å. Häggblad</i>	348
Biodegradation of sodium isopropyl xanthate by <i>Paenibacillus polymyxa</i> and <i>Pseudomonas putida K.A. Natarajan and M.R. Sabari Prakasan</i>	354
The selective leaching and separation of molybdenum from complex molybdenite concentrate containing copper Li-feng Li, Zhan-fang Cao, Hong Zhong, Ming-ming Wang, Guang-yi Liu, Shuai Wang and Xiao-yu Cao	361

SECTION 3: TRANSACTIONS PAPERS

This section contains papers published only in this volume. All papers passed peer review and were accepted for publication between October 16, 2012 and October 15, 2013.

Electrical injuries in the US mining industry, 2000-2009 G.T. Homce and J.C. Cawley	367
Methane-air explosion hazard within coal mine gobs J.F. Brune	376
Design and implementation of a polycarbonate safe haven wall in an underground coal mine <i>K.A. Perry and R.A. Meyr, Jr.</i>	391
Comparison of cap lamp and laser illumination for detecting visual escape cues in smoke <i>T.J. Lutz, J.J. Sammarco, J.R. Srednicki and S. Gallagher</i>	401
Experimental research on rock anchor corrosion in US underground coal mines A. Spearing, K. Mondal, G. Bylapudi and J. Weber	410
Ground condition mapping: a case study H. Lawson, E. Zahl and J. Whyatt	420
Examination of water spray airborne coal dust capture with three wetting agents J.A. Organiscak	427
Examination of redirected continuous miner scrubber discharge configurations for exhaust face ventilation system J.A. Organiscak and T.W. Beck	435
Case study of controlled recirculation at a Wyoming trona mine C. Pritchard, D. Scott and G. Frey	444
Challenges in CFD modeling of air flow in openpit mines K.V. Raj, W. Collingwood and S. Bandopadhyay	449
Stability analysis for steep-slope mines reclaimed using the forestry reclamation approach D. Kumar, J. Silva and R.J. Sweigard	457
Assessment of environmental impact of digging and loading equipment in surface coal mining A. Lashgari and V. Kecojevic	465
Case study: correcting control problems on Essroc's multi-drive station horizontally curved conveyor <i>A. Jennings, P. Perrone and J. Cornet</i>	472
Experimental and analytical validation of plain and reinforced concrete mine seal designs K.M. Mohamed, R.K. Zipf, D.F. Gearhart and T.J. Batchler	477
Tube bundle system studies at Signal Peak Energy Bull Mountains #1 Mine R.K. Zipf, R. Ochsner, R. Krog, W. Marchewka, M. Valente and R. Jensen	489
Technical considerations for the application of TBMs for mining projects D. Brox	498
Convection mechanisms for geothermal heat exchangers in a vertical mine shaft R. Thornton, N. Wahl and D.M. Blackketter	506
Strategic importance of nickel: scenarios and perspectives aimed at global supply A. Nieto, V. Montaruli and M. Cardu	510
Development of CISPM-MS and its applications in assessing multi-seam mining interactions <i>B. Qiu and Y. Luo</i>	519
Simulated learning model for mineable reserves evaluation in surface mining projects <i>M.A. Cuba, J.B. Boisvert and C.V. Deutsch</i>	527
Froude numbers and hydraulic jumps of open channel slurry flows B.E. Abulnaga and K. Rushdi	535
Direct upscaling of semivariograms and cross semivariograms for scale consistent geomodeling O. Babak, M.A. Cuba and O. Leuangthong	544
Complete index to the <i>Transactions of the Society for Mining, Metallurgy and Exploration, Inc.</i> , Vol. 334, 2013	553