



BM
BASE METALS
2023

COPPER COBALT AFRICA

IN ASSOCIATION WITH
THE 10TH SOUTHERN AFRICAN
BASE METALS CONFERENCE

13-15 JUNE 2023

AVANI VICTORIA FALLS RESORT,
LIVINGSTONE, ZAMBIA



Papers and Presentations

Outlook, Economics, and Sustainability

Developing an artisanal buying centre system meeting ethical sourcing criteria

N.C. Steenkamp and G. Bezuidenhout, *Independent Consultants, South Africa*

Cobalt's post-COVID recovery

J. Bedder, R. Chalale, and N. Backeberg, *Project Blue, South Africa and UK*

Benchmarking of water use efficiency in Southern Africa mines

Z. Maphumulo, *Department of Water and Sanitation, South Africa*

From graduate metallurgist to effective process engineer: The Metcelerate program

D. Drinkwater, R. Seitz, and J. Cilliers, *Metcelerate, UK, Australia and USA*

Mineralogy and Geometallurgy

Geometallurgy of cobaltiferous copper ores of the Chilean iron belt

R. Kuyvenhoven and B. Townley, *MDE Minerals Consulting, Chile and Universidad de Chile, Chile*

Comminution

Sustainable tailings reprocessing through efficient classification

Y. Reja, B. Zhang, A. Jain, and J.C. Makola, *Derrick Corporation, USA*

Effect of acid in the mill during milling in raffinate

F. Jantjies and N. Hadebe, *Mintek, South Africa*

Advantages of milling in high grade raffinate (acidic water) in Kimin Copper Project

R. Joshi, C. Li, W.Y. Xinchao, B. Singh, and A. Modi, *Somika Projects, DRC, CITIC Heavy Industries Co., Ltd, China and Vinmart Group, DRC*

Comparison of typical copper grinding circuits with approx. 15 ktpd throughput in Africa

C. Li, I. Druce, J. Dong, V. Nkuna, and W. Yuan, *Mills, CITIC Heavy Industries Co., Ltd, China, and Australia and Ivanhoe Mines SA (Pty) Ltd, South Africa*

Inclusion of a trommel screen on Kansanshi's sulphide ball mill

K. Chansa, E. Muleba, W. Little, and K. Ngosa, *First Quantum Minerals Ltd, Zambia*

SAG mill shell liner design – influence of liner dimensions and face angle on throughput and liner life

K.N. Kennedy, W. Little, E. Muleba, W.N. Nsofwa, and M. Phiri, *First Quantum Minerals Ltd, Zambia*

Gravity gold recovery improvements at Kansanshi Mine

I. Mkandawire, Z. Mahalihali, and P. Maxwell, *First Quantum Minerals Ltd, Zambia*

Flotation and Concentration

Use of continuous flotation operation data from plant surveys to characterize ore for the preparation of scale-up purposes

R.B. Khumalo and F.K. Mulenga, *University of South Africa, South Africa*

The use of cationic polymeric coagulants and other additives in addition to flocculation to improve overflow clarity, underflow density and suspended/colloidal silica in liquid/solid separation processes on the DRC Copperbelt

D. van Rensburg, M. Bower, S. Boskovic, T.B. Njojo, P.K. Sambisaya, and T.I. Nduba, *SNF ChemQuest Africa, South Africa, SNF UK, United Kingdom, Indorama plc, Thailand, Kamoa Copper Mine, DRC and SNF ChemQuest, DRC*

AERO® XR series collectors: Safer, custom-formulated alternatives to xanthates in various applications

R. Mumbi, M. Peart, B. Mbaob, J. Zulu, and E. Arinaitwe, *Solvay, Zambia, UK and USA*

Advances in the flotation of copper minerals

L. Mahlangu, C. Ngulube, S. Raju, and G. Zwane, *Clariant, South Africa*

Investigating a solution to the negative effects of aluminosilicate minerals on copper flotation with new chemistries

W.J. Rodrigues, W. Silva, V. Rhodes, P. Gonzaga, and S. Engelbrecht, *Clariant South America, Brazil and Clariant Sub Sahara Africa, South Africa*



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Papers and Presentations

Operational strategy to stabilize concentrate thickener performance

W.M. Nsofwa and B. Ng'ambi, *First Quantum Minerals Ltd, Zambia*

Dolomite flotation development for high GAC ore

M. Hatutale, P. Ilunga, R. Banza, T. Kalumba, J. Mostert, G. Ilu, S. Mwaba, J. Lenge, and Y. Makola, *Kamoto Copper Company, DRC*

The effects of different frothers on the copper, iron and silicate recoveries during natural flotation

C. Siame, S. Engelbrecht, C. Ngulube, and V. Mutentwa, *First Quantum Minerals, Kansanshi Mine, Zambia and Clariant Pty Ltd, South Africa*

An investigation into the natural response of chalcopyrite, pyrite, and other gangue to different frothing agents

M. Chibesa, C. Ngulube, S. Engelbrecht, and V. Mutentwa, *First Quantum Minerals, Kansanshi Mine, Zambia and Clariant Pty Ltd, South Africa*

Advances in reagent technologies for improved separations in sulfide mineral systems

E. Arinaitwe, *Solvay, USA*

Improvement of lead-zinc recovery through holistic organic carbon management at Dugald River

R. Webster, J.O. Connor, and D. Chipfunhu, *MMG Dugald River, Australia and BASF Australia Ltd, Australia*

Hydrometallurgy

Uranium removal from cobalt process liquor

N.C.J. Dempers, R.A. Wildenboer, and J.A.L. Parker, *SENET, South Africa, Rainbow Rare Earths, South Africa and Process Ideas, South Africa*

An investigation into copper, arsenic and zinc sulphide precipitation from acidic SX raffinate

N.C.J. Dempers, J. Nel, and S. Lunkov, *SENET, South Africa and Merdeka Copper Gold Tbk, Indonesia*

Modelling the kinetics of copper sulphide precipitation in bioleach liquor by utilizing bio-sulphide produced from a biological sulphate reduction process

R. Weideman and K. du Preez, *Mintek, South Africa*

Improving iron precipitation and other precipitation steps through data analysis and modelling

F. Crundwell, N. du Preez, and J. Christie, *CM Solutions (Pty) Ltd, South Africa*

Evaluation of flocculant performance on tailings thickener at Lubambe Mine

M. Mwansa, *ZCCM Investments Holdings Plc, Zambia*

Sustaining copper production by re-configuring the KMP hydromet wash circuit

E. Kamuchele and E. Chisulo, *First Quantum Minerals Ltd, Zambia*

Residual phosphorus control in the cobalt precipitation process

N. Mautsa, R. Pretorius, and M. Hesampour, *Kemira South Africa, Germany, and Finland*

Leaching

Optimization and prediction of Co³⁺ impurities enhanced dissolution in sulfuric acid

M. Bienvendu, J. Mvita, and A.F. Mulaba-Bafubandi, *University of Likasi, DRC and University of Johannesburg, South Africa*

High gangue acid consuming ore management at the Luilu refinery – impact of defoamer dosing at leach

P. Ilunga, G. Ilu, F. Banze, M. Kilumba, S. Mwaba, Y. Makola, and R. Nkomba, *Kamoto Copper Company, DRC*

Effect of LixTRA leaching aid on leaching of copper ores – column study

E. Mitshiabo and K.C. Sole, *BASF, South Africa, and University of Pretoria, South Africa*

Operation and production improvements in acid-leaching copper and cobalt by eliminating froth

N. Mautsa, *Kemira, South Africa*

EcoBiome - microbial enhanced metal recovery

M. Rodriguez, *EcoBiome Innovation Center, LLC, USA*

Bioleaching of a copper concentrate in the presence of chloride ions

N. Aphane, *Mintek, South Africa*



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Papers and Presentations

Understanding the impact of particle size distribution on leaching performance

N. du Preez and F. Crundwell, *CM Solutions (Pty) Ltd, South Africa*

Leaching of chalcopyrite in aqueous-alcoholic ferric sulphate media

J. Dinga, J. Petersen, and T. Moyo, *University of Cape Town, South Africa*

The acidic ferric sulfate leaching of primary copper sulfides under recycle solution conditions observed in heap leaching - Part 2: The effect of major species

G.P. O'Malley and A.N. Nikoloski, *Murdoch University, Australia*

Solvent Extraction

Flowsheet developments using CYANEX® reagents

B. Mbao, L. Thomas, G.L. Banza, W. Szolga, and T. McCallum, *Solvay, Zambia, South Africa, DRC, Canada and USA*

Sulphide ore conversion with biological mining processes for SX/EW processing

T Greenway and M Rodrigues, *African Process Engineering Company, South Africa and EcoBiome, UK*

United Nation Sustainability Goals and diluent properties relationship in SX processes

D. Bien and B. Bridier, *ExxonMobil Chemical Central Europe, Germany*

Quantification of copper in organic media from solvent extraction systems via portable X-ray fluorescence analysis

Z. Ruetz, *BASF Mining Solutions, USA*

Use of iron scraps and SO₂ to mitigate manganese oxidation issues in a starting copper SX-EW plant

P. Bwando, G. Mitshabu, and Y. Zhou, *BASF, DRC*

Evaluation of the applicability of high ketoxime extractant blends for copper solvent extraction plants of the Democratic Republic of Congo

G. Mitshabu, P. Bwando, E. Hajinasrollah, and A. Feather, *BASF, DRC and South Africa*

Metso Outotec VSF®X solvent extraction for Sicominex Project

H. Laitala and M. Lampi, *Metso Outotec Oy, Finland*

Exploiting outer-sphere coordination of protonated heterocyclic amines for selective solvent extraction of metal ions

K. Oosthuizen and R.C. Luckay, *Stellenbosch University, South Africa*

Separation of base metal ions using inner- and outer-sphere chemistry

R.C. Luckay, C. Ineza, N. Matinise, and K. Oosthuizen, *Stellenbosch University, South Africa*

Cobalt extraction from manganese and nickel metal ions using novel extractants

N. Matinise, C. Ineza, and R.C. Luckay, *Stellenbosch University, South Africa*

Acorga® CR60LT in the African copper belt: a new additive to mitigate crud formation in SX operations

B. Mbao, G.L. Banza, L.I. Nsenga, D. Muteba, and L. Thomas, *Solvay, Zambia, DRC, and South Africa*

Copper solvent extraction in Africa: Current practices and future applications

O. Tinkler, *Solvay, USA*

Improving SX performance and efficiency – A colloidal silica reduction solution

N. Makhotla, *Innospec Performance Chemicals, South Africa*

Cobalt extraction by Ionquest® range products: Studies of different leaching solutions from

C. Carrozza, M.S. Bruna, and F. Dutoy, *Italmatch Chemicals Italy and Belgium*

ACORGA® OPT5540: Advantages and contributions to copper extraction in the African copperbelt

B. Mbao, G.L. Banza, L. Thomas, and A. Argyn, *Solvay, Zambia, DRC, South Africa and Kazakhstan*

Ion Exchange

Value recovery and waste management using advanced ion exchange

L.L. Thompson and M. Darwood, *Chimerical Technology, South Africa and Ecovyst, UK*

The use of ion exchange to increase value in copper-cobalt operations

J. van Deventer, *Purolite, South Africa*



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Papers and Presentations

Electrowinning and Electrorefining

Enhancing the prediction capability of a dynamic electrowinning model through the inclusion of physicochemical property correlations

S. Grobbelaar, C. Dorfling, and M. Tadie, *Stellenbosch University, South Africa*

Comparison of the electrorefining process in different Cu alloys: Scientific challenges and prospects

D. Panias, D. Spanoudaki, E. Lappa, and E. Balomenos, *Technical University of Athens, Greece*

Cu-Fe alloy electrorefining at $\text{Cu}_2\text{SO}_4/\text{H}_2\text{SO}_4$ solutions

D. Spanoudaki, E. Lappa, E. Balomenos, and D. Panias, *National Technical University of Athens, Athens, Greece*

Investigation of the impacts of polyacrylamide additives on operational performance in copper electrowinning

I.L. Masoga, C. Dorfling, and M. Tadie, *Stellenbosch University, South Africa*

Pyrometallurgy

Improvements in the performance of copper ISASMELT™ furnaces with operational rigour

M. Prince, J. Edwards, B. Hogg, and S. Nicol, *Glencore Technology, Australia*

Position paper on cobalt alloy re-melting and recovery as cobalt rich slag

C. Nampungwe, C. Nguni, M. Simukoko, and W. Jilowa, *Konkola Copper Mines Plc, Zambia*

Sustainable copper production based on fluid bed roasting technology

M. Wrobel and J. Hammerschmidt, *Outotec GmbH & Co. KG, Oberursel, Germany*

Process Control and Optimization

Mill feed stabilization of the Kansanshi sulphide milling circuit during emergency feeding

K. Kankinza, B. Maas, F. van Zyl, and L. van der Bijl, *First Quantum Minerals, Kansanshi Mine Plc., Zambia*

The systematic improvement of a complex plant's metallurgical accounting – from locking out by-pass lines to installing accurate samplers and monitoring sample-preparation behaviours

I. Mkandawire, *Kansanshi Mining PLC, Zambia*

Hydrometallurgical process optimization of the Luishia Cu-Co project, DRC

M. Wu, B. Gao Bangfei, and Y. Wang, *China Railway Resources Co., Ltd., China and La Compagnie Minière de Luishia, SAS, DRC*

Smartfloat: Bringing AI to the flotation reagent world

J.P. Garnier, J.A. Garcia, T. Bhambhani and N. Renaud, *Solvay, France, Spain, and USA*

Solvextract: A digital tool to optimize solvent extraction performance

B. Mbaio G.L. Banza, L.I. Nsenga, W. Szolga, and T. Mccallum, *Solvay, Zambia, DRC, Canada and USA*

Process Development and Projects

Recycling of Li-ion batteries black matter by a thermochemical process

S.S. Windisch-Kern, A. Holzer, and H. Raupenstrauch, *Montanuniversitaet Leoben, Austria*

ERG's Metalkol Cobalt Purity Enhancement (CoPE) for the removal of zinc and cadmium from a base metal process solution – a comprehensive piloting programme

K.C. Sole, B. Knights, J. Wyette, D. Alexander, C.A. Snyders, and W. Banda, *Sole Consulting, South Africa, CM Solutions, South Africa, JW Consulting, South Africa, and ERG Management (Pty) Ltd, South Africa*