

PRESSURE HYDROMETALLURGY 2004

**International Conference on the Use of
Pressure Vessels for Metals Extraction and Recovery**

34th Annual Hydrometallurgical Meeting

**Banff, Alberta, Canada
October 23-27, 2004**



TECHNICAL PROGRAMME

MONDAY, OCTOBER 25, 2004, A.M.

9:00 - 9:15 - OPENING REMARKS: M.J. COLLINS AND
V.G. PAPANGELAKIS

PLENARY SESSION

Session Chairs:

V.G. PAPANGELAKIS, University of Toronto, papange@chem-eng.utoronto.ca

M.J. COLLINS, Dynatec Corporation, mcollins@mettech.dynatec.ca

Room: Salon C

Plenary No.: 1 - 9:15 - 10:00

Fifty Years of Pressure Hydrometallurgy at Fort Saskatchewan.

M.E. CHALKLEY, Sherritt International Corporation

10:00 - 10:15 Coffee Break

Plenary No.: 2 - 10:15 - 11:00

Bayer Process Alumina Production - Alcan Bayer Experimental Centre.

G. FORTÉ, Alcan International

Plenary No.: 3 - 11:00 - 11:45

Copper Pressure Leaching.

J. MARSDEN, Phelps Dodge Corporation

MONDAY, OCTOBER 25, 2004, P.M.

PRESSURE HYDROMETALLURGY
OF COPPER I

Session Chair: R. BEREZOWSKY, Dynatec, Canada, rberezowsky@mettech.dynatec.ca
Room: Salon B

Paper No. 1A.1 – 14:00 – 14:25

Testing and Modelling a Novel Iron Control Concept in a Two-stage Ferric Leach/Pressure Oxidation Process for the Sepon Copper Project.

K. BAXTER, T. PAVLIDES, Bateman Engineering, and
D. DIXON, University of British Columbia

Paper No. 1A.2 – 14:25 – 14:50

Concentrate Leach Plant Start-up, Operation and Optimization at the Phelps Dodge Bagdad Mine in Arizona.

J.C. WILMOT, Phelps Dodge,
R.J. SMITH and R.E. BREWER, Phelps Dodge

Paper No.: 1A.3 – 14:50 – 15:15

Copper Concentrate Pressure Leaching Studies at Anglo American Chile.

G. ZÁRATE and G. TAPIA, Anglo American

15:15 – 15:30 Coffee Break

LATERITES I

Session Chair: D. MUIR, CSIRO Minerals, Australia, david.muir@minerals.csiro.au
Room: Salon C

Paper No.: 1B.1 – 14:00 – 14:25

The Western Australian Ni Laterites Projects – What Have We Learned?

R.W. NICE, RW Nice & Associates Pty Limited

Paper No.: 1B.2 – 14:25 – 14:50

Effect of Process Water and Leach Temperature on the Leaching Behaviour of New Caledonian Nickel Laterite Ores.

M. BUARZAIGA and M. LAFRAMBOISE, Falconbridge

Paper No.: 1B.3 – 14:50 – 15:15

Effect of Ammonium, Sodium and Potassium Sulphates and Chlorides in the Pressure Acid Leaching of Western Australian Nickel Laterite Ore.

J.A. JOHNSON and B.I. WHITTINGTON, CSIRO Minerals

15:15 – 15:30 Coffee Break

PRESSURE HYDROMETALLURGY OF COPPER II

Session Chair: D. DIXON, University of BC, Canada, dixon@interchange.ubc.ca
Room: Salon B

Paper No.: 2A.1 – 15:30 – 15:55

The Effect of Surfactants on the Behaviour of Sulphur in the Oxidation of Chalcopyrite at Medium Temperature.

J.D.T. STEYL, Anglo American Research Labs (Pty) Limited

Paper No.: 2A.2 – 15:55 – 16:20

Hydrogen Reduction of Copper (I) Oxide in an Autoclave.

E. JÄÄSKELÄINEN, O. HYVÄRINEN and M. HÄMÄLÄINEN, Outokumpu Research

Paper No.: 2A.3 – 16:20 – 16:45

Hydrometallurgical Processing of Telfer Concentrates: Accepting and Winning the Challenge.

T. GIRAUDDO, D. LUNT, J. CANTERFORD, GRD Minproc Limited,

R. DUNNE, D. MITCHELL, formerly Newcrest Mining Services Limited, and

D. DREISINGER, University of British Columbia

Paper No.: 2A.4 – 16:45 – 17:10

Hydrogen Reduction of Copper and Nickel in the Processing of Copper Bleed Solution of Indian Sea Nodules.

V. KUMAR, B.D. PANDEY, D. BAGCHI and PREMCHAND,

National Metallurgical Laboratory of India

LATERITES II

Session Chair: D. KERFOOT, Inco Technical Services Limited, Canada, dkerfoot@inco.com
Room: Salon C

Paper No.: 2B.1 – 15:30 – 15:55

Chromium Removal from Leach Liquors Produced during High-pressure Acid Leaching of Nickel Laterite Ores.

M. BUARZAIGA and D. MARSHALL, Falconbridge Limited

Paper No.: 2B.2 – 15:55 – 16:20

Murrin Murrin CCD1 Rake Mechanism Modification: The Decision and the Result.

J. BELKE, Outokumpu Technology Pty Ltd.

B. HEWITT, Minara Resources

Paper No.: 2B.3 – 16:20 – 16:45

Kinetics of High Pressure Leaching of the Nickel Lateritic Ore.

S. STOPIC,

B.F. FRIEDRICH, IME Process Metallurgy & Metal Recycling, and

N. ANASTASIJEVIC, Outokumpu

Paper No.: 2B.4 – 16:45 – 17:10

Process Development Studies Carried out by Dynatec as Part of the Ambatovy Nickel Project Evaluation.

M.J. COLLINS, L.A. BARTA, K.R. BUBAN, R. KALANCHEY, G. OWUSU, R. RAUDSEPP, J. STIKSMA and

I.M. MASTERS, Dynatec Corporation

TUESDAY, OCTOBER 26, 2004, A.M.

PRESSURE HYDROMETALLURGY OF NICKEL SULPHIDES

Session Chair: D. DREISINGER, University of BC, Canada, drei@interchange.ubc.ca
Room: Salon B

Paper No.: 3A.1 - 8:30 - 8:55

Flammability of Ammonia Leach Solution Vapours under an Atmosphere of Enriched Oxygen.
J. BUDAC, M. SJOGREN, D. BELTON and R. KOFLUK, Sherritt International

Paper No.: 3A.2 - 8:55 - 9:20

Investigations of Method for Addition of Surfactant to the Process of Pressure Leaching of Nickel Containing Pyrrhotite.

A.V. TARASOV and E.M. TIMOSHENKO, State Research Institute of Non-Ferrous Metals

Paper No.: 3A.3 - 9:20 - 9:45

Development of an Effective Process for Pressure Disintegration of Sulphur-Sulphide Concentrates in the Hydrometallurgical Treatment of Nickel Pyrrhotite Materials.

M.N. NAFTAL, Norilsk, and

S. NABOICHENKO, The Urals State

9:45 - 10:30 Coffee Break

AUTOCLAVE DESIGN I

Session Chair: K. FRASER, Hatch, Canada, kfraser@hatch.ca
Room: Salon C

Paper No.: 3B.1 - 8:30 - 8:55

Oxidation Autoclave Agitation Review.

H. PIETERSE, Pieterse Consulting Inc.

Paper No.: 3B.2 - 8:55 - 9:20

Measurement of Oxygen Transfer Rate with an EKATO Gassing Agitator in a 5 m³ Pressure Vessel.

J. JI, Placer Dome Research Centre, and

J. KING, Placer Dome Tech Services Limited

Paper No.: 3B.3 - 9:20 - 9:45

Design and Materials Selection of Autoclaves and Auxiliary Equipment.

R. CLARY, P. CHEUNG and J. GULYAS, SNC Lavalin Australia Pty Limited

Paper No.: 3B.4 - 9:45 - 10:10

Quality Assurance Programs for Fabrication of Specialized Vessels and Exotic Alloy Piping.

W. BRISTOWE, A. HANSON and M. PEARSON, Hatch

10:10 - 10:30 Coffee Break

PRESSURE HYDROMETALLURGY OF PGMS

Session Chair: J. CANTERFORD, GRD Minproc, Australia, john.canterford@minproc.com.au
Room: Salon B

Paper No.: 4A.1 – 10:30 – 10:55

Development of a Process to Unlock Refractory Platinum Concentrates Prior to a Chloride-Assisted Pressure Leaching Process.

C.J. FERRON, C.A. FLEMING, SGS Lakefield,
D. DREISINGER, University of British Columbia, and
P.T. O'KANE, O'Kane Consultants

Paper No.: 4A.2 – 10:55 – 11:20

Modification of the Stillwater Base Metals Refinery Process.

L. NEWMAN, R. WYRICK, Stillwater Mining Company, and
R. BEREZOWSKY, Dynatec Corporation

Paper No.: 4A.3 – 11:20 – 11:45

A New Process for Treating Slimes after Copper and Nickel Electrowinning.

A.C. TER-OGANESYANTS, N. ANISIMOVA, G. KOTUKHOVA and G.N. DYLKO Norilsk Nickel

AUTOCLAVE DESIGN II

Session Chair: J. GULYAS, SNC Lavalin, Australia, Jim.Gulyas@snclavalin.com
Room: Salon B

Paper No.: 4B.1 – 10:30 – 10:55

Advantages of Bottom Entry Oxygen Introduction for Pressure Oxidation.

D.M. ADAMS, Lightnin, and
J.H. LAMMERS, Aker Kvaerner E&C

Paper No.: 4B.2 – 10:55 – 11:20

Slurry Dispersion Angle at Choke Outlet in Pressure Letdown with Multi-Phase Flows.

C.C. SMITH, Brigham Young University,
H. PIETERSE, Pieterse Consulting Inc.,
M. LUQUE, J. ROBISON and S. CHIPMAN, Caldera Engineering

Paper No.: 4B.3 – 11:20 – 11:45

Increasing the Capacity of New and Existing Exothermic Autoclave Circuits.

G.M. DUNN, Hydromet Pty Ltd.
H.W. SCRIBA.

TUESDAY, OCTOBER 26, 2004, P.M.

HIGH-TEMPERATURE MEASUREMENTS AND THERMODYNAMICS I

Session Chair: A. ALFANTAZI, University of BC, Canada, alfantaz@interchange.ubc.ca
Room: Salon B

Paper No.: 5A.1 – 14:00 – 14:25

Experimental Study of the Solubilities of Aluminum Oxy-hydroxo Phases to 300 °C.
D.A. PALMER, P. BÉNÉZETH and D.J. WESOLOWSKI, Oak Ridge National Laboratory
S. HILIC, AND-IT & Regulation Expertise for the Life Science Industry

Paper No.: 5A.2 – 14:25 – 14:50

Acid-Base Ionization and Metal Complexation under Hydrothermal Conditions by UV-Visible and Raman Spectroscopy.
L.N. TREVANI, P. TREMAINE and W.W. RUDOLPH, University of Guelph

Paper No.: 5A.3 – 14:50 – 15:15

In Situ pH Monitoring of High Concentration Acidified Geothermal Brines and Acidic Sulphate Solutions at Elevated Temperatures.
S.N. LVOV, X.Y. ZHOU, S.M. ULYANOV and Z.F. Zhou, Pennsylvania State University,
Z. JANKOVIC and V.G. PAPANGELAKIS, University of Toronto

15:15 – 15:30 Coffee Break

MATERIALS OF CONSTRUCTION I

Session Chair: M. BUARZAIGA, Falconbridge TC, Canada, mbuarzaiga@sudbury.falconbridge.com
Room: Salon C

Paper No.: 5B.1 – 14:00 – 14:25

Design Fundamentals for Hydrometallurgical Pressure Vessel Refractory Linings.
A. KONING and P. LAUZON, Hatch

Paper No.: 5B.2 – 14:25 – 14:50

A Comparison of Refractory Lined and Metal-clad Process Vessels for Specific Operating Conditions.
L. ZUNTI and M. PEARSON, Hatch

Paper No.: 5B.3 – 14:50 – 15:15

Impact of Mortar Properties on the Integrity of an Autoclave Brick Lining System.
G. HUDON, Y. PÉPIN and J-F. TURGEON, Rio Tinto Iron & Titanium

15:15 – 15:30 Coffee Break

HIGH-TEMPERATURE MEASUREMENTS AND THERMODYNAMICS II

Session Chair: P. TREMAINE, University of Guelph, Canada, tremaine@uoguelph.ca
Room: Salon B

Paper No.: 6A.1 – 15:30 – 15:55

Ammonia Pressure Hydrometallurgy: Estimation of High Temperature Stability Constants for Metal Ammine Complexes.

K. OSSEO-ASARE and S.W. ASIHENE, Penn State University

Paper No.: 6A.2 – 15:55 – 16:20

The Thermodynamics of Titanium Corrosion in Acidic Systems.

J. VAUGHAN and A. ALFANTAZI, University of British Columbia

Paper No.: 6A.3 – 16:20 – 16:45

Acidity Estimation at Temperature by Conductivity in Pressure Acid Leach Solutions.

M. HUANG and V.G. PAPANGELAKIS, University of Toronto

MATERIALS OF CONSTRUCTION II

Session Chair: R. KALANCHEY, Dynatec, Canada, rkalanch@mettech.dynatec.ca
Room: Salon C

Paper No.: 6B.1 – 15:30 – 15:55

Ball Valves with Nanostructured Titanium Oxide Coatings for High-Pressure Acid-Leach Service: Development to Application.

J. WILLIAMS, Williams: Mogas Industries, Inc.,

G.E. KIM, Perpetual Technologies, Inc., and

J. WALKER, F.W. Gartner Thermal Spraying Co.

Paper No.: 6B.2 – 15:55 – 16:20

Severe Service Ball Valve Design Analysis Utilizing a Modified Kepner-Tregoe Method.

P. LAUZON, L. NIGHTINGALE-MERCER, M. PEARSON, Hatch, and

J. IRVINE, ABI Consultants

Paper No.: 6B.3 – 16:20 – 16:45

Brick Linings in High Pressure Acid Leaching (HPAL) Vessels.

H. FELDHEISER, DSB-Säurebau GmbH

Paper No.: 6B.4 – 16:45 – 17:10

Reliable and Economic Use of Masonry Lining Technology for Hydrometallurgical Applications.

T.E. CRANDALL, R.J. WAKEFIELD, R.E. ALIASSO, R.J. STORMS and J. VAN DER MERWE, Stebbins Engineering & Manufacturing Company

WEDNESDAY, OCTOBER 27, 2004, A.M.

PRESSURE HYDROMETALLURGY OF REFRACTORY GOLD I

Session Chair: J. MCMULLEN, Barrick Gold, Canada, jmcmullen@barrick.com
Room: Salon B

Paper No.: 7A.1 - 8:30 - 8:55

Reducing the Energy Consumption of the Barrick Goldstrike Autoclave.
S. CASHIN, D. KASHUBA and W. ESPLIN, Barrick Gold

Paper No.: 7A.2 - 8:55 - 9:20

High Temperature POX of Precious/Base Metal Concentrates from Newmont's Phoenix Project,
Using Controlled Precipitation of Sulphate Species to Enhance Silver Recovery.
G.L. SIMMONS and J.C. GATHJE, Newmont Mining Corporation

Paper No.: 7A.3 - 9:20 - 9:45

Safety Protocols for Campbell Mine Autoclave Shutdowns.
M. TIMMINS, Placer Dome Campbell Mine

Paper No.: 7A.4 - 9:45 - 10:10

Pilot Plant Evaluation of a Hybrid Biological Leaching-Pressure Oxidation Process for
Auriferous Arsenopyrite/Pyrite Feedstocks.
I. DYMOV, C.J. FERRON, SGS Lakefield, and
W. PHILLIPS, Kinross Corporation

10:10 - 10:30 Coffee Break

PROCESS DEVELOPMENT STUDIES I

Session Chair: M. DRY, Consultant, Canada, mdry3@cogeco.ca
Room: Salon C

Paper No.: 7B.1 - 8:30 - 8:55

Hydrothermal Synthesis of Functional Inorganic Materials from Aluminum Recycling Wastes.
J. SHIBATA, N. MURAYAMA and H. YAMAMOTO, Kansai University

Paper No.: 7B.2 - 8:55 - 9:20

Production of Thorium Concentrate from Egyptian Monazite.
A.M. ABDEL-REHIM, Alexandria University

Paper No.: 7B.3 - 9:20 - 9:45

Pressure Acid Leaching of Non-ferrous Smelter Slags for the Recovery of their Base Metal
Values.

W. CURLOOK, University of Toronto,
V.G. PAPANGELAKIS and M. BAGHALHA, University of Toronto

Paper No.: 7B.4 - 9:45 - 10:10

Features of High-temperature Oxidation of Non-ferrous Metal Sulphides and Pyrite in Acidic
Sulphate Solutions under Oxygen Pressure Conditions.
S.S. NABOICHENKO and K.N. BOLATBAEV, The Ural State Technical University

10:10 - 10:30 Coffee Break

PRESSURE HYDROMETALLURGY OF REFRACTORY GOLD II AND ZINC I

Session Chair: G. DEMOPOULOS, McGill University, Canada, george.demopoulos@mcgill.ca
Room: Salon B

Paper No.: 8A.1 – 10:30 – 10:55

Process Modifications to the São Bento Concentrator of Eldorado Gold.

L. SILVA, R. GUIMARÃES, São Bento Mineração S.A., and
J. MILBOURNE, AMEC Mining & Metals Consulting

Paper No.: 8A.2 – 10:55 – 11:20

Experiences with Zinc Pressure Leaching of 100% Red Dog Concentrate at Teck Cominco.
C. D'ODORICO, Teck Cominco Limited

Paper No.: 8A.3 – 11:20 – 11:45

Commercialization of the Dynatec Zinc Pressure Leach Process at Kazakhmys.

S. SADYKOV, Kazakhmys Corporation,
E. McCONAGHY, J. STIKSMA, K. BUBAN, J. OFSTIE and R. KALANCHEY, Dynatec Corporation

AUTOCLAVE DESIGN III

Session Chair: J. BUDAC, Sherritt International, Canada, jbudac@sherrittmetals.com
Room: Salon C

Paper No.: 8B.1 – 10:30 – 10:55

Special Design Considerations for Pressure Hydrometallurgy Pilot Plants.

P. MARTIN, Zeton Inc.

Paper No.: 8B.2 – 10:55 – 11:20

Self-cleaning Fluidized Bed Slurry Heat Exchangers: Processing of Laterite Ore Slurries
for the Extraction of Nickel and Cobalt in High-pressure Acid Leach (HPAL) Plants.

D. G. KLAREN, E.F. de BOER, Klaren BV, and
B. CROSSLEY, Met Chem Cons.

WEDNESDAY, OCTOBER 27, 2004, P.M.

PRESSURE HYDROMETALLURGY OF ZINC II

Session Chair: J. DUTRIZAC, CANMET, Canada, jdutriza@nrcan.gc.ca
Room: Salon B

Paper No.: 9A.1 - 14:00 - 14:25
Autoclave Application for Zinc Leach Residue Treatment by Akita Zinc Co. Ltd.
Y. KUDO and H. ARIMA, Akita Zinc Company

Paper No.: 9A.2 - 14:25 - 14:50
The Hematite Process - New Concepts for Increased Throughput and Clean Hematite
Production.
T.C. CHENG and G. DEMOPOULOS, McGill University

Paper No.: 9A.3 - 14:50 - 15:15
Mathematical Modelling of Pressure Leaching of Sulphide Zinc Concentrate.
E.M. VIGDORCHIK, E.E. ZHMARIN, Y.M. SHNEERSON, A.Y. LAPIN and V.M. SHPAER, Gipronickel
Institute

15:15 - 15:30 Coffee Break

PROCESS DEVELOPMENT STUDIES II

Session Chair: M. COLLINS, Dynatec, Canada, mcollins@mettech.dynatec.ca
Room: Salon C

Paper No.: 9B.1 - 14:00 - 14:25
Applications of NSC Pressure Leaching.
C. ANDERSON, CAMP-Montana Tech

Paper No.: 9B.2 - 14:25 - 14:50
Interactions of Ferriferous Copper-Nickel Mattes with Sulphuric Acid: Study of Chemistry
and Kinetics.
M.I. KALASHNIKOVA, Y.M. SHNEERSON and M.V. KESKINOVA, Gipronickel Institute

Paper No.: 9B.3 - 14:50 - 15:15
Recovery of Europium and Yttrium from Spent Fluorescent Lamps.
M.A. RABAH, Central Metallurgical R&D Institute (CMRDI)