TECHNICAL PROGRAM
- Plenary Lectures
- Movement of Copper & Economic Industrial Outlook
- Applications and Fabrication
- Mineral Processing
- Hydrometallurgy
- Electrowinning
- Electrorefining
- Pyrometallurgy—Smelting Operations
- Pyrometallurgy—Fundamentals, Process Modeling, and Technology Development
- Environment & Safety

RANDOL INTERNATIONAL TRADE EXHIBITION
- Copper Processing
- Smelting
- Copper Extraction
- Hydrometallurgy
- Environmental Management

POST CONFERENCE TECHNICAL TOURS
- Kennecott Utah Copper
- Mineral Processing
- Smelting Operations
- Refineries
- Hydrometallurgical Practices
- Fabrication

SHORT COURSES
- Advances in Concentrate Smelting and Converting
- Cost Effective Tailings Disposal
- Copper Heap Leaching
- Hydrometallurgical Treatment of Concentrates
- Copper Hydromet Roundtables

Registration and Housing Forms Enclosed

OCTOBER 10–13, 1999
Pointe Hilton Resort on South Mountain
Phoenix, Arizona, USA
Each volume may be purchased individually at the conference price listed below, or purchase the entire, six-volume set at the additionally discounted price.

Presentations have been divided into six, hardbound volumes.

VOLUME I: Plenary Lectures/Industry Outlook & Economics/Applications & Fabrication
Approx. 600 pages • Order No. 4356
Conference Price $95

VOLUME II: Mineral Processing/Environment & Safety
Approx. 614 pages • Order No. 4364
Conference Price $95

VOLUME III: Electrorefining & Electrowinning
Approx. 740 pages • Order No. 4372
Conference Price $95

VOLUME IV: Hydrometallurgy
Approx. 740 pages • Order No. 4380
Conference Price $95

VOLUME V: Pyrometallurgy—Smelting Operations
Approx. 810 pages • Order No. 4399
Conference Price $95

VOLUME VI: Pyrometallurgy—Fundamentals, Process Modeling & Technology Development
Approx. 810 pages • Order No. 4402
Conference Price $95

You may pre-order your selections on the conference registration form found in this brochure and you may have them sent directly to you by selecting the shipping option and paying an additional charge. All volumes will be available for pick-up at the meeting.

Note: These special prices are only available for advance orders and during the meeting (ending October 13, 1999).

Use Order No. 4410 for the six-volume set.
COPPER 99–COBRE 99 SITE & TECHNICAL INFORMATION

**DATE AND VENUE**

Copper 99 - Cobre 99 is the fourth in a series of international conferences devoted to mineral processing and the extractive metallurgy of copper. Conference participants will gain insight into important worldwide technological advancements, potential new commercial developments and opportunities, as well as understanding the challenges confronting the industry as it heralds the 21st century.

Held every four years, the Copper-Cobre conferences are organized by The Chilean Institute of Mining Engineers (IMCH), The Metallurgical Society of the Canadian Institute of Mining, Metallurgy and Petroleum (CIM), and The Minerals, Metals and Materials Society (TMS). For Copper 99 - Cobre 99, The Society of Mining, Metallurgy and Exploration (SME) is serving as a sponsoring society.

Copper 99 - Cobre 99 will take place from October 10 to 13, 1999, at The Pointe Hilton Resort on South Mountain in Phoenix, Arizona, USA. The Pointe Hilton Resort on South Mountain is a Four Star, Four-Diamond Resort with exceptional meeting facilities.

**TECHNICAL PROGRAM**

The Copper 99 - Cobre 99 technical program will commence at 8:30 AM on Monday, October 11, 1999 and conclude at 5:00 PM on Wednesday, October 13, 1999. Some 260 oral presentations are expected. Additional details regarding the technical program appear on page 17.

The Technical Program for this conference will provide the most extensive assembly of papers for a copper industry event this century. The conference will encompass all modern processing aspects of the copper industry, from the mineral processing stage through to finished metal and fabricated products via the smelting/electrorefining route, or via leaching/SX-EW operations. As well, there are sessions covering economics, finance, environment and safety issues. Overall, the conference will outline the state of the art for the entire industry, which is poised for great things in the next millennium. All the details can be found starting on page 17. This is one event that you cannot afford to miss.

**LETTERS OF INVITATIONS**

The Copper 99 - Cobre 99 Organizing Committee will issue letters of invitation to individuals requiring such a document. Such letters though, do not commit the Copper 99 - Cobre 99 Organizing Committee to providing financial support. Fax, E-mail or mail your request for letter of invitation to:

Michael Packard, Manager, Meeting Services TMS, Meeting Services Department 184 Thorn Hill Road, Warrendale, PA 15086, USA Fax: 724-776-3770; E-mail: packard@tms.org

**PROCEEDINGS VOLUMES**

Proceedings volumes will be available for sale at the conference. Delegates may reserve copies at pre-conference prices by completing the appropriate section in the Advance Registration Form. There will be six (6) volumes offered at Copper 99 - Cobre 99.

Volume 1: Plenary Lectures/Industry Outlook & Economics/Applications
Volume 2: Mineral Processing/Environment & Safety
Volume 3: Electrorefining & Electrowinning
Volume 4: Hydrometallurgy
Volume 5: Pyrometallurgy—Smelting Operations
Volume 6: Pyrometallurgy—Fundamentals, Process Modeling and Technology Development

**EXHIBITION**

An added feature of Copper 99 - Cobre 99 is a trade exhibition. The Copper 99 - Cobre 99 Organizing Committee, in conjunction with Randol International, is organizing an exhibition of products and services for improved copper & byproduct extraction, recovery and environmental management. The exhibition will be held in the Exhibit Pavilion, adjacent to The Pointe Hilton Convention Center, from Sunday, October 10 - Wednesday, October 13, 1999. For additional information and to reserve your exhibit space, complete the Booth Reservation Form on page 15 and return it to:

Dennis Sigl, VP Exhibitions Randol International, Ltd. 13701 W. Jewell Avenue, #14 Lakewood, CO 80228 Phone: 303-986-5579; Fax: 303-986-5577 E-Mail: randolinternational@worldnet.att.net

**COPPER HYDROMET ROUNDTABLE 99**

Organized by Randol International Ltd., and to be held all day Sunday, October 10, 1999. The Copper Hydromet Roundtable 99 is an interactive and valuable international networking opportunity designed for operating and project managers at all levels. Copper Hydromet Roundtable 99 offers an excellent opportunity for metallurgists and engineers involved in the development of new hydrometallurgical technologies, processes and applications to network with a broad spectrum of international experts and operating managers. This years Copper Hydromet Roundtable 99 will comprise four major panel discussions: 1) Heap & Dump Leaching, SW-EW; 2) Bio-Oxidation; 3) Concentrate Leaching and 4) Cost Reduction Options: A Systems Approach. Analogous processes and applications for other base metals derived from copper hydrometallurgy will also be presented and discussed.

Nominations and applications for panel participation on hot items in the four panel topics are open. For more information, check the conference page at www.randol.com and for registration or participation queries, contact Hans von Michaelis Randol International Ltd Golden, CO 80401 Phone: 303-526-1626; Fax: 303-526-1650 E-Mail: hansvon@hotmail.com

To register for the Copper Hydromet Roundtables, complete the Roundtable Registration Form on page 13 and return it to Randol International, at the address listed above, by September 20, 1999. A separate registration of US $200.00 will be charged for participation in the Copper Hydromet Roundtable.
COPPER 99–COBRE 99 SITE & TECHNICAL INFORMATION

**L A T E • N E W S • P O S T E R • S E S S I O N •**

Additional submissions will be considered as Late News Posters. This will function as a regular Poster Session to be run on Tuesday, October 12, 1999 from 10:30 AM - 4:00 PM, in parallel with the other sessions.

In a departure from previous Copper - Cobre Conferences, this poster session was considered important for Copper 99 - Cobre 99 in view of the high interest shown in the conference and the fact that a number of abstracts were received after the deadline. Poster session abstracts, which should be no longer than 150 words, will be reviewed as they are received, and acceptance will be communicated to the authors within about 10 days of receipt.

Anyone wishing to participate in the conference, but has missed the oral presentation deadline, may submit their abstract for review through the TMS web site via the Conference Management System (http://www.tms.org/cms) or by contacting the TMS Programming Department at 724-776-9000, ext. 227 or by fax at 724-776-3770. Please identify submission as a poster session. The final deadline for submitting abstract is Friday, September 10, 1999.

**P O L I C Y • O N • A U D I O / V I D E O • R E C O R D I N G • O F • T E C H N I C A L • P A P E R • P R E S E N T A T I O N S / S E S S I O N S •**

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COPPER 99–COBRE 99 REGISTRATION & HOUSING INFORMATION

**R E G I S T R A T I O N •**

Copper 99 - Cobre 99 attendees, including authors, session chairs and exhibitors are required to register. To register, complete the Advance Registration Form on page 9 and return it by September 20, 1999 to:

TMS Customer Service Department
184 Thorn Hill Road
Warrendale, PA 15086, USA
Phone: 724-776-9000 x270
Fax: 724-776-3770
csc@tms.org

You may now register any time day or night via the Copper 99 - Cobre 99 Home Page on the World Wide Web at http://www.tms.org/Meetings/Specialty/Copper99/Copper99.html. TMS OnLine also provides detailed information on this and all TMS-sponsored conferences.

Full payment in US dollars must accompany the completed Advance Registration Form. Register by September 20, 1999 to receive a $100.00 discount off of the on-site fee.

Onsite Conference registration hours:

**Sunday, October 10, 1999**
Welcoming Reception ............................... 5:30 PM–7:00 PM

**Monday, October 11, 1999**
Exhibit Reception ........................................ 5:30 PM–7:00 PM

**Tuesday, October 12, 1999**
Conference Banquet ................................. 6:00 PM–9:00 PM

**A C C O M M O D A T I O N S •**

The Headquarter’s Hotel and site for Copper 99 - Cobre 99 are at The Pointe Hilton Resort on South Mountain, Phoenix, Arizona, USA. Located on the boundary of Phoenix and Tempe, the 700-acre resort sits beside the world’s largest municipal park, Phoenix’s South Mountain Preserve. The resort offers luxurious two-room suites to all its guests with minibars, coffee-makers, remote control/cable TV and two telephones.

An important component of the Copper - Cobre conferences is the opportunity to meet with representatives of the industry from all over the globe. In this respect, the Copper 99 - Cobre 99 venue at The Pointe Hilton Resort on South Mountain in Phoenix, Arizona will provide excellent opportunities for networking, discussions with colleagues and associates to search for that unique way to make your company, or your project more comprehensive. Space is available for impromptu meetings and discussions, who knows, your next new idea to save money for your company may start here.

At the end of a busy and fulfilling day at the conference, the 42,000 square-foot Sports Club offers extraordinary range of recreational activities including fitness training, racquetball and a full-service hair and nail salon. Guests...
also enjoy mountain biking and horseback riding. Locally, there are two championship 18-hole golf courses: Phantom Horse Golf Course on South Mountain and the Raven at South Mountain. There are a variety of foods for all tastes at The Pointe Hilton Resort on South Mountain. Enjoy fabulous American Cuisine, at Another Pointe in Tyme. Spicy authentic Mexican delights are served at Aunt Chilada’s, or for a taste of Arizona on South Mountain, enjoy Phantom Horse Grill, offering the flavors of the Southwest. Adjacent to the grill, The Sports Bar features satellite TV’s, appetizers, drinks and dancing, or to get a taste of the Old West at Rustler’s Rooste in its remarkable views of the city; lighter poolside favorites at La Cabana or Juegos Cantina.

Participants should mail or fax their Copper 99 – Cobre 99 Housing Form as early as possible to The Pointe Hilton Resort on South Mountain. The housing cut-off date is September 8, 1999. After September 8, 1999, the conference rate and availability of the suites at The Pointe Hilton on South Mountain may not be available.

The Pointe Hilton Resort on South Mountian, 7600 N. 16th Street, Suite 130, Phoenix, AZ 85020; Phone: (800) 876-4683; Fax: (602) 870-2783.

COPPER 99–COBRE 99 INDUSTRIAL TOUR

Tours will depart and return to The Pointe Hilton Resort on South Mountain. Space is limited on each individual tour. Reservations will be accepted on a first-come basis. The Organizer reserves the right to cancel any tour for which registration is undersubscribed; in the event of cancellation or over-subscription, a full refund will be made. All tours include baggage gratuities for up to two bags per person.

To register for the Industrial Tours, complete the Advance Registration Form on page 9 and return it by September 20, 1999 to TMS.

Technical Tour 1: Kennecott Utah Copper Thursday, October 14 - Friday, October 15, 1999

$755 per person
Limit 15 persons

Kennecott Utah Copper operates the Bingham Canyon open pit mine, copper mill, concentrator, and a modern copper smelter and refinery. The Garfield Smelter includes Kennecott-Outokumpu flash smelting of concentrate and Kennecott-Outokumpu flash converting of matte. The refinery, which produces 300,000 tons of cathode copper per year, features The Kidd Process with automatically guided vehicles to transport process materials.

Day 1: Depart from The Pointe Hilton Resort on South Mountain at 3:30 PM. Deplane in Salt Lake City at 7:36 PM. A bus transfer will take you to the Comfort Inn in Sandy, Utah. Dinner at the Wagonmaster Restaurant. Return to hotel. The cost of the hotel and dinner are included in the price of the tour.

Day 2: Continental Breakfast is included. Checkout from the hotel (baggage can be stored under the bus) and depart at 8:00AM by bus for Kennecott Utah Copper. Tour Kennecott Utah Copper. In the middle of the tour, a boxed lunch will be served between the Bingham Canyon and Garfield facilities. Depart Kennecott Utah Copper for dinner at the Green Street Social Club. After dinner, depart restaurant for Salt Lake City International Airport. Arrive in Phoenix at 9:19 PM, and return by bus to The Pointe Hilton Resort on South Mountain. Hotel accommodations for the evening of October 15 are not included; please make your own reservations with The Pointe Hilton on South Mountain.

Technical Tour 2: Milling of Copper Ores Thursday, October 14 - Friday, October 15, 1999

$350 per person
Limit 20 persons

The Arizona copper belt offers a variety of ore types, for which various milling practices have evolved. This two-day tour of four copper milling operations provides opportunity to compare mill practices at two operations for each of two major copper producers.

Day 1: Depart by bus from The Pointe Hilton Resort on South Mountain at 7:00 AM for Asarco Ray Operations. Tour the modern, 30,000 tpd Asarco Ray Complex concentrator. A box lunch will be provided on the bus, en route to Phelps Dodge Morenci. After touring the Morenci milling operations, the group will depart by bus at 5:00 PM for the historic mining town of Silver City, New Mexico. Rooms have been reserved at the Comfort Inn. Dinner at the Red Barn Steakhouse in Silver City. The cost of the hotel and dinner are included in the price of the tour.

Day 2: Continental breakfast at the Comfort Inn. Depart the hotel at 7:30 AM for a tour of the milling operations of the Chino Mining Co., Hurley, New Mexico. After the tour, depart by bus for Asarco Mission Complex, Sahuarita, Arizona. A box lunch will be served on the bus. Tour the Asarco Mission Complex, including a recently installed secondary crushing facility. Return to The Pointe Hilton Resort on South Mountain at approximately 7:30 PM. Hotel accommodations and dinner for the evening of October 15 are not included; please make your own reservations with The Pointe Hilton on South Mountain.
Technical Tour 3: Smelting Operations  
**Thursday, October 14 - Friday, October 15, 1999**  
$350 per person  
Limit 25 persons

This two-day tour will visit Arizona’s three operating copper smelters, which include three different smelting technologies.

**Day 1:** Depart by bus from The Pointe Hilton Resort on South Mountain at 7:30 AM for Cyprus Miami. After a tour of the (Isasmelt) smelting and related facilities, the group will have lunch at El Rey in Globe. Depart by bus for Asarco Hayden. After the tour of Asarco Hayden (Inco flash) smelter, the group will drive to Tucson, Arizona. Rooms have been reserved at the Ramada University Resort. Once settled in your room, the bus will depart for the Stardance cookout area for a western barbecue (menu to be determined) and a cash bar, accompanied by strolling guitarists and astronomers. After dinner, return to the Ramada University Resort. The cost of the hotel and dinner are included in the price of the tour.

**Day 2:** Full complimentary breakfast at the Ramada University Resort. Depart the hotel at 7:30 AM for a visit to BHP’s San Manuel operations. The tour will include the recently relined smelter, and the converting, anode casting and anode handling facilities. After a group lunch in San Manuel, return to The Pointe Hilton Resort on South Mountain at approximately 2:30 PM. Hotel accommodations and dinner for the evening of October 15 are not included; please make your own reservations with The Pointe Hilton on South Mountain.

**Technical Tour 4: Refineries**  
**Thursday, October 14, 1999**  
$95 per person  
Limit 20 persons

This one-day trip will include comprehensive tours of Arizona’s two major copper refineries.

**Day 1:** Depart by bus from The Pointe Hilton Resort on South Mountain at 7:30 AM for BHP’s San Manuel. Tour the refinery and ancillary operations. A box lunch will be provided, en route to Cyprus Miami. After touring the Cyprus Miami refinery and ancillary operations, the group will return to The Pointe Hilton Resort on South Mountain at approximately 5:30 PM. Hotel accommodations and dinner for the evening of October 14 are not included; please make your own reservations with The Pointe Hilton on South Mountain.

**Technical Tour 5: Hydrometallurgical Practices**  
**Thursday, October 14 - Friday, October 15, 1999**  
$350 per person  
Limit 20 persons

Four leaching operations will be visited over a two-day period

**Day 1:** Depart by bus from The Pointe Hilton Resort on South Mountain at 7:30 AM for a visit to BHP’s Florence, Arizona pilot in situ leach operation. Depart by bus to Asarco’s new Silver Bell leach/SX/EW operations. A box lunch will be served en route. After the tour of Asarco Silver Bell, the group will depart by bus at approximately 3:00 PM to Safford, Arizona. Rooms have been reserved at the Ramada Spa Resort. After checking in, the bus will depart for the Golden Corral Steakhouse for a buffet dinner (no cash bar - family restaurant). Return to the Ramada Spa Resort. The cost of the hotel and dinner are included in the price of the tour.

**Day 2:** Complimentary continental breakfast at the Ramada Spa Resort. Depart the Resort early for a tour of Phelps Dodge Morenci 133,000 tpd heap leach and associated SX/EW operations. After the tour a box lunch will be provided on the bus traveling to Cyprus Miami. Tour the leaching and SX/EW operations there, and return to The Pointe Hilton Resort on South Mountain at approximately 7:00 PM. Hotel accommodations and dinner for the evening of October 15 are not included; please make your own reservations with The Pointe Hilton on South Mountain.

**Technical Tour 6: Copper Fabrication**  
**Thursday, October 14 - Friday, October 15, 1999**  
$275 per person  
Limit 20 persons

Copper 99 - Cobre 99 will supplement the applications programming with a tour of four plants forming copper products by casting, forging, drawing and electroforming, using both primary and secondary copper materials.

**Day 1:** Depart by bus from The Pointe Hilton Resort on South Mountain at 7:30 AM for Tucson Foundry. Tour this large casting shop before having a group lunch at Pinnacle Peak Steakhouse in Tucson, Arizona. Depart by bus to San Manuel. After the tour of BHP’s rod plant there, the group will return by bus to the Phoenix area for dinner which will take place at Alcatraz Brewing Company (choice of entrée - limited menu and a sample of five mini beers). Return to The Pointe Hilton Resort on South Mountain at approximately 8:30 PM. Hotel accommodations for the evening of October 14 are not included; please make your own reservations with The Pointe Hilton on South Mountain. Dinner is included in the price of the tour.

**Day 2:** Breakfast on own at the hotel. Depart The Pointe Hilton Resort on South Mountain at 8:30 AM for a tour of Gould Electronics, Chandler, Arizona, which produces foils by electroforming. After the tour, the group will have lunch at Jackson’s on Third in Phoenix, and then depart by bus for Cable Systems International, Phoenix. Tour CSI. Return to The Pointe Hilton Resort on South Mountain at approximately 4:30 PM. Hotel accommodations and dinner for the evening of October 15 are not included; please make your own reservations with The Pointe Hilton on South Mountain.
“Advances in Concentrate Smelting and Converting”
Saturday, October 9
8:30 AM–5:00 PM
$350 per person

Who Should Attend:
This course is intended for project and plant engineers who wish to update their knowledge on the technologies, which are available to expand or modernize existing smelters, and to improve on their ability to analyze smelter operations and the options to decrease operating costs and emissions.

Course Content will include:
This course will focus on the technologies that are available to improve existing smelters or to expand them, discussing the critical subjects which determine the selection of smelting and converting processes, such as:
- Plant Capacity and Existing Facilities
- Applicable Environmental Regulations
- Energy and Type of Fuel Availability and Costs
- Type of Feed and Impurities
- Degree of Automation Desired
- Intensity of Use of Oxygen
- Gas Handling and Acid Manufacture
- Operating Costs
- Investment Costs

A presentation will also be made of some of the principles and tools available to analyze the smelting and converting processes, such as the materials and energy balances, and plant modeling by the use of modern software.

About the Presenter:
Antonio A. Luraschi currently a Partner and Head, Process Engineering, CADE IDEPE Eng. Dr. Luraschi’s engineering and research experience is mainly in the field of Copper Smelting and Refining, Project Technical and Economic Evaluation, Plant Emissions Analysis and Control, Molybdenum and Vanadium Extractive Metallurgy, and the Pyrometallurgical Processing of Precious Metals.

“Cost Effective Tailings Disposal”
Sunday, October 10
8:30 AM–5:00 PM
$350 per person

Who Should Attend:
This one day learning intensive course will be of interest to mine managers, concentrator superintendents, tailings operations superintendents and staff, mine engineering and environmental staff, design engineers and environmental scientists involved with tailings disposal.

Course Content will include:
- Tailings Disposal Methods
- Recent developments in Tailings Disposal
- Tailings Impoundment Failures
- Design of On-Land Tailings Impoundments
- Tailings Impoundment Configurations
- Evaluation of On-Land Tailings Deposition Methods
- Marine Disposal Methods

About the Presenters:
Han Ilhan is currently a Senior Project Engineer working on assignment in Salt Lake City, Utah. Mr. Ilhan has over 15 years of geotechnical engineering experience focusing on tailings dam and heap leach pad work for the mining industry.

Pedro Repetto is currently Vice-President and Manager of the Geotechnical Engineering Group, Denver, Colorado. Mr. Repetto has over 30 years of experience which include experience with basic studies and investigations, design, permitting, preparation of bidding documents, and construction phase services for mine tailing projects.

Jim Obermeyer, P.E., has over 25 years of diversified heavy civil engineering experience providing services for the mining industry. His experience includes providing design criteria, preparing plans and specifications, cost estimating, construction engineering and project management for tailing dam, earth and earth-rock dam and waste storage projects.
Chris Hatton, P.E. has over 10 years of diversified heavy civil engineering and environmental engineering experience providing services for the mining industry. He has been responsible for the investigation, evaluation, design, construction, and rehabilitation of civil engineering structures and environmental projects throughout the western United States.

“Copper Heap Leaching”
Co-sponsored by SME
Saturday & Sunday
8:00–6:00 PM
October 9 thru 10
$500 per person

Who Should Attend:
Copper heap and dump leaching contributes significantly to the production of copper from oxide and sulfide ores. This course offers an overview of the regulatory, theoretical and practical aspects of copper heap leaching. Much attention is given to the importance of ore testing and ore geochemical characteristics. Ore preparation and the practical aspects of project design, construction and operation are presented. This course is of particular interest to developers of copper heap leach projects, project managers, design professionals, and mining and metallurgical engineers. State and Federal officials will also find this course applicable to their regulatory responsibilities.

Course Content will include:
● Overview of Copper
● Ore Testing
● Geotechnical Aspects of Copper Heap Leaching
● Rock Fabric/Ore Preparation
● Heap/Dump Leaching and Solution Application
● Design of SX-EW Plants
● Regulatory Framework and Permitting
● Bioleaching
● Economics of Copper Heap Leach Design

About the Presenters:
A.J. Liguori is a 1972 graduate of the University of Arizona, with over 17 years experience in copper processing. He served as Chief Metallurgist for Magma Copper for seven years prior to becoming the Director of Divisional Metallurgical Services.

Corale Brierley has over 20 years of research, development and applications experience in bioleaching and other metal-related technologies. Dr. Brierley is now a Denver based consultant to the mining, chemical and water treatment industries in the areas of bioleaching, environmental management and marketing/business development.

John E. Dreier holds a Ph.D. in geology and geochemistry for the University of Arizona. He has explored and developed gold, silver and copper deposits, and has worked as an environmental geochemist.

Dale A Deming has nineteen years of experience in the mining industry as a mining engineer and environmental engineer/manager. His expertise covers four western states for copper, gold, uranium, and lead/zinc industries, with specialization’s in hazardous waste management/remediation, mine permitting, reclamation planning and implementation, archaeological oversight, environmental audits, compliance oversight, and has working knowledge of federal environmental laws.

Joseph M. Keane began his association with the mining industry as an underground miner at age 16. He is currently President of Metcon Research, Inc. and KD Engineering Co., Inc. in Tucson, Arizona. He is a Registered Professional Metallurgical Engineer in nine states.

Gary Kordosky holds an MS degree in Organic Chemistry and Ph.D. in Inorganic Chemistry, both from Ohio State University where his research interests were in organometallic chemistry and coordination chemistry. He is currently the International Business Director for the Minerals Industry Division of Henkel Corporation.

Dirk Van Zyl is a Principal with Golder Associated Inc., Denver. He has more than 15 years experience in consulting and research associated with geotechnical aspects of waster disposal for the mining industry in South Africa and North America.

“Hydrometallurgical Treatment of Copper Concentrates”
Saturday & Sunday
8:00 AM–6:00 PM
October 9 thru 10
$500 per person

Who Should Attend:
The course is ideally suited to all those involved in copper hydrometallurgy research and development. Graduate students, professors, government scientists, industrial researchers and operators will benefit from their participation.

Course Content will include:
The purpose of this course is to provide an overview of the current state of development of hydrometallurgical alternatives to conventional smelting and refining of copper concentrates. The emerging alternatives include (in alphabetical order): Activox Copper Process, Biological Leaching, CESL Copper Process, Dynatec Copper Process, INTEC Copper Process, MIM Nenatech Copper Process and the Total Pressure Oxidation Process. Representatives from each development company have been invited to present an in depth lecture on their technology and its application. In addition, experts on the leaching of copper concentrates and the application of solvent extraction and electrowinning to copper recovery from concentrate leaching will present detailed lectures on these topics. A panel discussion by the presenters is planned at the conclusion of the short course.

About the Presenters:
Ian Corrans, Oreetest, Perth, Australia.
The Activox Copper Process.
Paul Miller, (on Request)
Bactech, Perth, Australia.
The Bactech Copper Bioleach Process.
David Jones,
CESL, Vancouver, Canada.
The CESL Copper Process.
Accompanying persons tours have been customized to enhance the Copper 99 - Cobre 99 conference experience. To register, please complete the Advance Registration Form in this mailer on page 9 and return it to TMS. Tour tickets will be included in your Advance Registration Packet in the Copper 99–Cobre 99 registration area at the meeting. Please note that reservations will be handled on a first-come, first-serve basis.

Pre-registration for the tour program will be accepted up to September 20, 1999. Tours will not be scheduled unless sufficient pre-registration is received. Therefore, please make your reservations early.

Tour desk registration hours:

**Sunday, October 10, 1999**
1:00 PM–7:00 PM

**Monday, October 11, 1999**
7:00 AM-1:00 PM

**Tuesday, October 12, 1999**
7:00 AM-1:00 PM

**Wednesday, October 13, 1999**
7:00 AM–Noon

All tours will originate and end at The Pointe Hilton Resort on South Mountain. Prices indicated include transportation and lunches.

Accompanying Persons Tour 1: “Red Rock Fantasy”

8:00 AM-5:00 PM
($75.00 per person) Monday, October 11, 1999

Much photographed Oak Creek Canyon and the picture-postcard town of two of Arizona's most scenic spots, second only to the Grand Canyon. Drive the most dramatic approach to the canyon, through sagebrush country brightened with sycamore-lined washes, where the earth itself begins to change color, from white to orange to red. The preserved cliff dwellings of Montezuma Castle are your first stop, and a chance to stretch your legs. Here, the dramatic limestone cliffs tell the story of the Sinagua civilization that vanished 800 years ago. Enjoy a buffet luncheon at the Sedona Swiss Restaurant and Café, and the breathtaking views of the red rocks of Sedona. Explore the shops and studios of Sedona’s artists and craftsmen, Shop at Tlaquepaque, or venture into the newest shopping realm of Hozho. Surrounded by the unique architecture of the Arizona territory.
Accompanying Persons Tour 2:
“Timeless Treasures”
($50.00 per person) Tuesday, October 12, 1999
9:00 AM–1:00 PM
Travel through the citrus groves to the Heard Museum to see a collection of arts and crafts of ancient cultures as well as contemporary works. Discover pottery, rugs, baskets, turquoise jewelry and a room devoted to Barry Goldwater’s Kachina (spirit) doll collection, more than 400 varieties. The “southwest studies” exhibit features three actual Indian dwellings: a Navajo hogan, an Apache wickieup and a Hopi corn grinding room - as they look on today’s reservations. Visitors to these interactive displays come away with a new appreciation for the strength and beauty of Native American ways of life. Luncheon will be at a restaurant converted from a historic old home that’s been restored to its original beauty.

Accompanying Persons Tour 3:
“The Savory Southwest”
Cooking Demo & Luncheon
9:00 AM–1:00 PM
($75.00 per person) Wednesday, October 13, 1999
Enjoy southwestern cuisine with a French flair in the relaxed atmosphere of a historical Phoenix residence. Owner-chef Vincent Guerithault will prepare your gourmet luncheon right before your eyes! Quality, French cooking at its best — the presentation is pure artistry, looking almost too good to eat.

The restaurant was awarded Phoenix Magazine’s coveted “Golden Spoon Award” in a reader’s favorites poll, and Chef Vincent was named “Chef of the Southwest” at the 1993 James Beard competition in New York.

Next, head to the Biltmore Fashion Park, which offers more than fifty fine shops in a park-like setting with fountains, flowers and lovely shaded areas. Home to Saks Fifth Avenue, Macy’s, Banana Republic, Polo/Ralph Lauren, Origins, MAC Cosmetics, Gucci, Ann Taylor and other exclusive specialty stores. The Biltmore also houses many fine restaurants including Wolfgang Puck’s ObaChine, and is the Phoenix location of hotspots Planet Hollywood and the Hard Rock Cafe.
### Advance Registration Form

**Copper 99 - Cobre 99**  
10 – 13 October 1999, Phoenix, AZ, USA

**Advance Registration Deadline:** 20 September 1999  
**Payment must accompany form.**  
Forms received past this date will be processed at the on-site fee structure.

**Instructions:** Check your selections, and fill in the necessary information.

#### Social Function Tickets

<table>
<thead>
<tr>
<th>Event</th>
<th>Fee Number</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welcoming Reception, 10 Oct. 1999</td>
<td>$25</td>
<td>R</td>
</tr>
<tr>
<td>Banquet, 12 Oct. 1999</td>
<td>$60</td>
<td>B</td>
</tr>
<tr>
<td>Luncheon Package 1-13 Oct. 1999</td>
<td>$75</td>
<td>L</td>
</tr>
</tbody>
</table>

**Dietary Restrictions:**  
- Vegetarian (V)  
- Kosher (K)  
- Low Fat (F)  
- Low Salt (S)  
- Diabetic (D)

#### Total Fees:

- Registration Fees
- Short Course Fees
- Publications
- Industrial Tour Fees
- Accompanying Person Tour Fees
- Social Function Tickets

#### Advance Registration Deadline: 20 September 1999

**Payment Options:**  
- Check payable to TMS. Payment should be made in US dollars drawn on a US bank or via the following.
  - VISA  
  - MasterCard  
  - American Express  
  - Bank Transfer*  
  *Attach a copy of your bank wire transfer document. Wire payment to PNC Bank, Pittsburgh, PA, routing number 043000096, account number 1008259767; referencing “Cu 99” and your name.

**Cardholder Name:** ________________________  
**Card No.:** ________________________  
**Exp.:** _________________  
**Signature:** ________________________

**Refund Policy:** Written requests must arrive at TMS, no later than 20 Sept. 1999. A $50 processing fee will be charged for all registration and/or short course cancellations.

---

**Registration Fees**

- Advance Fees to 20 Sept. 99  
- On-Site Fees after 20 Sept. 99

<table>
<thead>
<tr>
<th>Event</th>
<th>Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Conference</td>
<td>$495</td>
<td>$525</td>
</tr>
<tr>
<td>Retired – Full Conference</td>
<td>$250</td>
<td>$300</td>
</tr>
<tr>
<td>Student (A copy of your school identification card must accompany this form.)</td>
<td>$150</td>
<td>$225</td>
</tr>
</tbody>
</table>

**Short Course Fees**

- Advance Fees to 20 Sept. 99  
- On-Site Fees after 20 Sept. 99

<table>
<thead>
<tr>
<th>Event</th>
<th>Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advances in Melting &amp; Converting of Copper Concentrates</td>
<td>$350</td>
<td>$400</td>
</tr>
<tr>
<td>Cost Effective Tailing Disposal: 10 Oct. 1999</td>
<td>$350</td>
<td>$380</td>
</tr>
<tr>
<td>Copper Heap Leach: 9–10 Oct. 1999</td>
<td>$500</td>
<td>$550</td>
</tr>
<tr>
<td>Hydrometallurgical Treatment of Copper Concentrates: 9–10 Oct. 1999</td>
<td>$500</td>
<td>$550</td>
</tr>
</tbody>
</table>

**Publications**

- Will be available for pick-up at the meeting.
- Price  
- Number  
- Total

<table>
<thead>
<tr>
<th>Volume</th>
<th>Price</th>
<th>Number</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume 1: Plenary Lectures/Industry</td>
<td>$95</td>
<td></td>
<td>$95</td>
</tr>
<tr>
<td>Volume 2: Mineral Processing/Environment &amp; Safety</td>
<td>$95</td>
<td></td>
<td>$95</td>
</tr>
<tr>
<td>Volume 3: Electrorefining &amp; Electrowinning</td>
<td>$95</td>
<td></td>
<td>$95</td>
</tr>
<tr>
<td>Volume 4: Hydrometallurgy</td>
<td>$95</td>
<td></td>
<td>$95</td>
</tr>
<tr>
<td>Volume 5: Pyrometallurgical Operations</td>
<td>$95</td>
<td></td>
<td>$95</td>
</tr>
<tr>
<td>Volume 6: Pyrometallurgy Fundamentals, Processing, Modeling &amp; Technological Developments</td>
<td>$95</td>
<td>$4610</td>
<td></td>
</tr>
<tr>
<td>Six Volume Set</td>
<td>$495</td>
<td></td>
<td>$495</td>
</tr>
<tr>
<td>Shipping Charges (U.S.A. and Canada)</td>
<td>$10 per book</td>
<td>$10</td>
<td></td>
</tr>
<tr>
<td>Shipping Charges (ELSEWHERE)</td>
<td>$20 per book</td>
<td>E</td>
<td></td>
</tr>
</tbody>
</table>

**Industrial Tour Fees**

<table>
<thead>
<tr>
<th>Event</th>
<th>Fee Number</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tour 1: Kennecott Utah Copper: 13-14 Oct. 1999</td>
<td>$755</td>
<td>T1</td>
</tr>
<tr>
<td>Tour 2: Milling of Copper Ores: 14-15 Oct. 1999</td>
<td>$350</td>
<td>T2</td>
</tr>
</tbody>
</table>
Reserve a房间 at Pointe Hilton South Mountain Resort for the COPPER 99 – COBRE 99 CONFERENCE occurring from October 10 – 13, 1999. Please complete the form below and return to:
The Pointe Hilton South Mountain Resort
Attn: Reservations Manager
7600 N 16th Street, Suite 130
Phoenix, AZ 85020
Phone: (800) 876-4683
Fax: (602) 870-2783

I Plan to arrive: ___________________________ Date
I Plan to Depart: ___________________________ Date

Please check:
☐ Single/Double - $175
☐ Concierge Level - $195
☐ Executive Boardroom Suite - $300
☐ Presidential Suite - $400

Room Tax - 10.55%

All reservations must be received by: WEDNESDAY, SEPTEMBER 8, 1999
Requests prior to and after convention dates will be accepted on a space available basis only.
Convention rate applies three days prior and three days following official meeting date. (One card per room)

NAME:______________________________ Payment Enclosed: ☐ CHECK ☐ CREDIT CARD

FIRM: ______________________________

ADDRESS:__________________________ CARD NO: __________________________

CITY, STATE, ZIP:__________________ EXPIRATION DATE: __________________

TELEPHONE: _______________________
☐ VISA ☐ MASTERCARD ☐ AMERICAN EXPRESS

FAX: ______________________________
☐ OTHER __________________________

Specific Requests: ____________________ SIGNATURE: _______________________
(Requests Subject to Availability)

HHONORS NUMBER: __________________

PLEASE NOTE: CHECK-IN TIME IS 4:00PM • CHECK-OUT TIME IS 12 NOON
COPPER HYDROMET ROUNDTABLE 99
REGISTRATION FORM ONLY

• The Pointe Hilton Resort on South Mountain, Phoenix, Arizona, USA
   Essential Opportunity for Copper Metallurgy Managers
   Sunday, October 10, 1999

Name: ____________________________________________________________
Title: ____________________________________________________________
Company: _________________________________________________________
Address: _________________________________________________________
Phone: ___________________________________________________________
Fax: _____________________________________________________________

ENCLOSED IS MY REGISTRATION FOR THE FOLLOWING:
☐ Delegate: Copper Hydromet Roundtable (includes admittance to the exhibition but not the Copper 99 - Cobre 99 Technical Sessions) .............. US $200
☐ Proceedings of Randol at Vancouver 98/Copper Hydromet Roundtable 98 ........................................................................................................... US $95
☐ Proceedings of Randol at Vancouver 97/Copper Hydromet Roundtable 97 ........................................................................................................... US $95
☐ Proceedings of Randol at Vancouver 96/Copper Hydromet Roundtable 96 ........................................................................................................... US $95

Total US $ ____________________________

REGISTRATION INCLUDES:
• AM and PM Breaks
• Lunch
• Reception in the Copper 99–Cobre 99 Exhibition

METHOD OF PAYMENT  ☐ Check Enclosed  ☐ Visa  ☐ MasterCard  ☐ American Express

Card #: ___________________________________________________________
Expiration Date: ___________________________________________________
Name: ___________________________________________________________
Signature: _________________________________________________________

Please E-mail or fax Roundtable registration to:
Hans von Michaelis
Randol International Ltd
21578 Mountsfield Drive, Golden, CO 80401
Fax: 303-526-1650
E-mail: hansvon@hotmail.com

To register for the Copper 99–Cobre 99 Conference please fill out the Registration Form on page 9.
COPPER 99 - COBRE 99 EXHIBITION

BOOTH RESERVATION FORM

The Pointe Hilton Resort on South Mountain,
Phoenix, Arizona, USA
October 10–13, 1999

Name: ________________________________________________
Title: ________________________________________________
Company: ____________________________________________
Address: _____________________________________________
City: _________________________________________________
State: _______________________________________________
Zip: _________________________________________________
Phone: ______________________________________________
Fax: _________________________________________________
E-mail: ______________________________________________

**BOOTH SELECTION**

☐ 1st Choice
☐ 2nd Choice
☐ 3rd Choice

**METHOD OF PAYMENT**

☐ Check Enclosed  ☐ Visa
☐ MasterCard  ☐ American Express

Card #: ______________________________________________
Expiration Date: ______________________________________
Name: ______________________________________________
Signature: ___________________________________________

**Booth Cost—$1,500 US Includes:**

- 8’ x 10’ Exhibit area
- One 6’ Skirted Table
- One Armchair
- One Spotlight for Lighting
- One Delegate Registration for Copper Hydromet Roundtable 99 Panel Discussion on Sunday, October 10, 1999.

**Hours of Operation:**

**Move-in:**
Saturday, October 9, 1999

**Show Times:**
Sunday, October 10, 1999 ....................... 4:30 AM–7:30 PM
Monday, October 11, 1999 ......................... 10:00 AM–7:30 PM
Tuesday, October 12, 1999 ....................... 10:00 AM–7:30 PM
Wednesday, October 13, 1999 .............. 10:00 AM–3:00 PM

**Please E-mail or fax Booth Reservation Form to:**
Dennis Sigl
Randol International Ltd.
13701 W. Jewell Avenue, #14
Lakewood, CO 80228
Fax: 303-986-5577
E-mail: randolinternational@worldnet.att.net
COPPER 99 - COBRE 99  
Technical Program  
Preliminary Program

PLENARY LECTURES

Coordinators: G. A. Eltringham, BHP Copper Inc., 550 California St., San Francisco, CA 94104-1020; P. J. Mackey, Noranda Technology Center, 240 Hymus Blvd., Pointe Claire, Quebec H9R 1G5 Canada

Markets for Copper—present and into the Millennium: Paul Dewison 1; 1Metalica Ltd., Forge Cottage, Ousden, Suffolk, CB8 8TR, England

The Financial Performance of the Copper Industry: Some Comparisons: P. Kettle 1; 1CRU International Ltd., 31 Mount Pleasant, London WC1X OAD England

World Technology Developments in Copper Through the 20th and 21st Centuries: Dr. W. G. Davenport 1; 1University of Arizona, #12 Dept. of Mats. Sci. and Eng., Tucson, AZ 85721 USA

World Scenario Planning with Emphasis on Issues Affecting the Copper Industry: Peter Schwartz 1; 1Global Business Network, P.O. Box 8395, Emeryville, CA 94662 USA

Copper Competitiveness in Relation to Other Metals: TBA 1; 1Codelco-Chile, Huérfanos 1270, Santiago, Chile

Advances in the Copper Industry - Future Development and Environmental Constraints: Dr. W. Marnette 1; 1Norddentsche Affinerie, Hovestraße 50, Hamburg, Germany D-20539

MOVEMENT OF COPPER AND INDUSTRIAL OUTLOOK

Coordinators: Norbert L. Piret, Piret & Stolberg Partners, Consulting Engineers, Im Licht 12, Düsseldorf, Germany D-47279; Aldo Piccozzi, Chile

Markets and Trends

Trends and Insights into Worldwide Copper Acquisition Activity: Douglas B. Silver 1; 1Balfour Holdings, Inc., 10 Inverness Dr. East, Suite 104, Englewood, CO 80112 USA

The Role of Brazil in the Copper Market: A 21st Century Supply and Demand Prospects: Eduardo Vale 1; 1Bamburra, Planejamento e Economia Mineral Ltda., Rio de Janeiro Caixa Postal 37005, Brazil

Global Copper Consumption into the New Millennium: Gary A. Campbell 1; 1Michigan Tech University, SBE, 1400 Townsend Dr., Houghton, MI 49931 USA


The 21st Century: A Century for the Chuquicamata Mine: Juan H. Rojas 1; 1Codelco Chile, Division Chuquicamata, Chuquicamata, Chile

Copper, Market Growth Potential and Threats in the Asia Pacific Region: Thomas Astorga 1; Raul F. Campusano 1; 1GEMEED-APEC, Dept. of Mining Chile

Risk Management in the New Millennium: John M. Rogers 1; 1SGS Mineral Services, 1, Place des Alpes, P.O. Box 2152, Geneva 1 CH-1211

Meeting the Environmental Challenge by the Copper Industry in Chile: Lessons from the 90’s: Jaime Solari 1; 1SGA Ibersis, Encomenderos 260, Piso 9, Las Condes, Santiago Chile

The Chilean Copper Smelter Management Way: Sergio Demetrio 1; C. Queirolo 1; R. Campos 1; L. Conteras 1; J. Sanhueza 1; E. Morales 1; M. A. Duran 1; R. Alvarado 1; 1Chuquicamata Smelter, 1Altonorte Smelter, 1Potrillillos Smelter, 1Paijote Smelter, 1Ventanas Smelter and Refinery, 1Chagres Smelter, 1Caletones Smelter

The Group of Experts on Minerals and Energy Development and its Role Regarding Copper Mining Sustainability in the Asia-Pacific Region: Thomas Astorga 1; Raul F. Campusano 1; 1GEMEED, Dept. of Mining, Chile

Economics - Finances

Project Phasing and the Bottom Line: C. Twigge-Molecey 1; D. Dawson 1; 1Hatch, 2800 Speakman Dr., Mississauga, Ontario L5KZR7 Canada

Indirect Benefits of Private Mining Investment in Chile: G. E. Lagos 1; G. Donoso 1; M. Andia 1; 1Catholic University of Chile, Vicuna Mackenna 4860, Santiago Chile

The Price-Stock Relationship in the Copper Market: A Surprising Approach: Pablo Pinchera Brown 1; 1Division of Policy Plannings, Cochilco, Agustinas 1160, 4º Piso, Santiago, Chile

Comparative Post-Evaluation of Mining Projects: P. F. Knights 1; J. Hyslop 1; 1Catholic University of Chile, Vicuna Mackenna 4860, Santiago Chile

Making Outsourcing Decisions with Incremental Analysis: Bruce Cavender 1; 1BHP Copper, Inc., 8866 N. Duskfire Dr., Tucson, AZ 85737 USA
COPPER APPLICATIONS AND FABRICATION

Applications

Influence of Environment on the Copper Patinas: M. A. Llavona;
1University of Oviedo, Dept. of Mats. Sci., U.S. of Mining and Topo-
graphic Eng., Reinerio Garcia, Mieres 33600 Spain

The Motor Motor Rotor and Plastic Injection Molds - New Develop-
ments Relying on Copper’s Conductivity: Dale T. Peters; John G.
Cowie;
1Copper Development Association, Inc., 260 Madison Ave., 16th
Floor, New York, NY 10016 USA

A Review of Bismuth and Selenium Modified Copper Alloys for
Plumbing Applications: M. Sahoo;
1L. V. Whiting;
1M. Sadayappan;
1D.
T. Peters; 1CANMET, Mats. Tech. Lab., 568 Booth St., Ottawa, Ontario
K1A 0G1 00233 Canada; 1Copper Development Association, NY USA

Copper for Long Term Isolation of High Level Nuclear Waste: Lars
O. Werme;
1Swedish Nuclear Fuel and Waste Management Co. (SKB),
Stockholm Sweden

Progress Report On Development Of A Cu-8 Cr-4 Nb Alloy Data-
base For The Reusable Launch Vehicle (RLV): David Ellis;
1H. Man
Yun;
1Case Western Reserve University, White Blvd., 10900 Euclid Ave.,
Cleveland, OH 44106-7204 USA; 1Cleveland State University, 1983 East
24th St., Cleveland, OH 44115 USA

Study of Sulphide Ion in Corrosion Copper Resistance for Using
in Containers for High Level Waste: Ivan Escobar;
1Commission
Chilena de Energia Nuclear, Casilla 188-D, Santiago Chile

Bilingual Copper Information Database: Helga Larravide;
1Konrad
Kundig;
1Procorbe-Chile; 1Delta Met Int., 2 School House Rd., Randolph,
NJ 07869

Deterioration of Copper Electrodes in the Resistance Spot Weld-
ing of Aluminum: J. R. Groza;
1D. Bojin;
1S. Steffensen;
1University of California at Davis, Dept. of Chem. Eng. and Mats. Sci.,
Davis, CA 95616 USA; 1Polytechnic Institute, Bucharest Romania

Copper and Chlorinated Polyvinyl Chloride as Materials for Po-
table Water Usage: William H. Dresher;
1WHD Consulting, 1201 E.
Placita Ardilla, Tuscon, AZ 85718 USA

Fabrication

Effect of Oxygen Content on Annealing Kinetics of Copper: Les
Strezov;
1BHP Research & Technology Development, Centre for Metal-
lurgy and Resource Processing, Newcastle Laboratories, P.O. Box 188,
Wallsend, NSW 2287 Australia

Rheology and Metal Forming of Fire Refined Copper (FR): Carlos
Camurri;
1Concepcion University, Dept. of Metall., Casilla 53-C,
Concepcion Chile

Mechanical Properties of a Family of Yellow Brasses Cast in Per-
mament Molds: F. A. Fasoynu;
1R. Bouchard;
1J. Thomson;
1M. Sahoo;
1Materials Technology Laboratory (CANMET), 568 Booth St., Ottawa,
Ontario K1A 0G1 Canada

The Effect of Nickel on the Mechanical Properties of High Strength
Yellow Brass: D. G. Schmidt;
1R. Lavin and Sons, Inc., 3426 S. Kedzie
Ave., Chicago, IL 60623 USA

Microstructural Refinement and Strength Enhancement of Cu-4
Cr-2 Nb Alloy by Mechanical Milling: K. R. Anderson;
1University of California, 5209 Dredger Way, Dept. of Chem. Eng. and
Mats. Sci., Davis, CA 95616 USA

Grain Refinement of Copper Base Alloys: M. Sadayappan;
1F. A.
Fasoyinu;
1M. Sahoo;
1Materials Technology Laboratory (CANMET), 568 Booth St., Ottawa ON K1A 0G1 Canada

Application of Mechanical Alloying Processing to the Formation
of Copper-Carbid Alloys: Victor Vargara;
1M. Lopez;
1R. Benavente;
1C. Camurri;
1B. Cartes;
1H. Olivella;
1Univ De Concepcion, Casilla 53-C,
Concepcion 00187 Chile

Improved Rod Plant Metal Control with UNAC: A. A. Shook;
1BHP Copper, Suite 200, 7400 North Oracle Rd., Tucson, AZ
85737 USA

MINERAL PROCESSING

Concentration - Operations

Improvements of Flotation Efficiency at the El Salvador Moly Plant
by Flowsheet Modifications and Type Flotation Machines: Sergio
Castro;
1Universidad de Concepcion, Departamento de Ingenieria
Metalurgica, Casilla 53-C, Concepcion Chile

Phosphate Nokes Process at El Teniente By-Product Molybdenite
Plant: S. H. Castro;
1C. Henriquez;
1E. Bear;
1Universidad de Concepcion,
Dept. of Metall. Eng., Casilla, Concepcion 53-C Chile; 1Codelco-Chile El
Teniente Division, Rancagua Chile

Copper Ore Preconcentration by Heavy Media Separation for Re-
duced Capital and Operating Costs: Walter E. McCulloch;
1John D.
Hightower;
1Roshan B. Bhappu;
1Bateman Engineering, Inc., 1860 E.
River Rd., Suite 300, Tuscon, AZ 85718 USA; 1Mountain States R & D
International

Technological Development for Igarape Bahia/Alemao Copper-
Gold Project: Vania Lucia Lima;
1Nilce Alves dos Santos;
1Rinaldo Pedro
Nardi;
1Companhia Vale do Rio Doce - CRVD

Gold Occurrence in the Sar-Cheshmeh Prophyrty Copper Ore and
Its Behaviour during Beneficiation: Mohammad Mehdi Salari Rad;
1Masami Tsunekawa;
1Tsuyoshi Hirajima;
1Tetsuro Yoneda;
1Hokkaido
University, Graduate School of Engineering, Mineral Processing Lab.,
Kiat 13, Nishi 8, Sapporo, Hokkaido 060-8628 Japan

Equipment

A New Revolutionary Method of Classification: The Pansep Screen:
Rein Buisman;
1Particle Separation Systems (PTY), Ltd., P.O. Box 6575,
Bishops, Gauteng 1767 South Africa

Evaluation of a Ultrasomics Grinding Process: Luis G. Gaete;
1Universidad de Santiago de Chile, Departamento de Fisica, Laboratorio de
Ultrasomidos, Casilla 307, Santiago 2 - Chile
Magnetic Collection of Grinding Ball Fragments from Sag and Ball Mill Circuits: Daniel A. Norrgren; Michale J. Mankosa; 1 Eierz Manufacturing Company, P.O. Box 10608, Erie, PA 16514-0608 USA

FUD vs Conventional and Column Flotation: Daniel Urizar Funes; 1 UPM LTDA

Advances in Application Driven Design of Flotation Cells: Jouko Kallioniemi; Daniel Monchak; 1 Dorr-Oliver, 333 South Allison Parkway, Suite 304, Denver, CO 80226 USA

Next Generation Sedimentation Equipment for Ultimate Thickening: Alex Probst; Jim Bowerson; 1 Dorr-Oliver, Inc., 333 South Allison Parkway, Suite 304, Denver, CO 80226-4656 USA

Development of Heat Treated Grinding Rod Altasteel: Geoff Clinton; 1 Altasteel Marketing

Operation Optimization

Ball Level Setting and Control in Semi-autogenous Grinding: Luis Magne; Waldo Valderrama; Fernando Bassarre; Gilda Titichoca; 1 University of Santiago de Chile, Metallurg. Eng., Dept., Avda. L.B. O’Higgins 3363, Santiago, Chile; 2 Federico Santa Maria University of Technology, Mats. Sci. Dept.; 3 Candelaria Minning Company

Feeding Granulometric Profile: The Most Incidental Variable in Semi-Autogenous Grinding Output: Fernando E. Cartes; 1 Domingo F. Baenza; 1 Codelco-Chile, Division El Teniente, Millan 1040, Rancagua Chile

The Recovery - Enrichment Ratio Model (AREV Equation): Marco A. Vera; J-P. Franzidis; Emmy V. Manlapig; 1 JKMR - The University of Queensland, Dept. of Mining, Mins., and Mats. Eng., University Mine, Isles Rd., Indooroopilly, Brisbane, Queensland 4068 Australia

Predictive Erosion Modeling for Hydrocyclone Liners: Jim F. Benjamin; Mark E. Hoyack; Brian LaCourse; 1 Keto Engineering, Product Development, 5505 W. Gillette Rd., Tucson, AZ 85743 USA; 2 Saint-Gobain Industrial Ceramics, Northboro R&D Center, Goddard Rd., Northboro, MA 01532 USA

Metal Seated Ball Valves for the Flow Control of Abrasive Fluids: Malcolm J. Harrison; 1 Valtechtechnologies, Inc., Mining Div., 3227 Clayton Rd., Suite 10, Concord, CA 94519 USA

Operator Training in Collahuasi: Marty Messner; 1 Performance Associates International, Inc., 760 E. Pusch View Lane, Suite 100, Tucson, AZ 85737 USA

Milling for the Millennium: Stuart M. Jones; R. Fred Pena; 1 Metallic Minerals Svedala, Sales and Market., York, PA USA

Optimization and Control

Distribution of Pb Ions in Cu Rougher Flotation: Comparison of the Three Cu/Zn Concentrators: J. C. Cremmelt; C. Sui; J. A. Finch; 1 McGill University, Dept. of Mining and Metall. Eng., Montreal, Quebec H3A 2B2 Canada

Effect of Clay Slimes on Copper, Molybdenum Flotation from Porphyry Ores: S. Balatovic; 1 Lakefield Research, Ltd., 185 Concession St., Postal Bag 4300, Lakefield, Ontario K0L 2H0 Canada

Mineral Fragmentation and Porphyry Copper Process Design: P. D. Munro; 1 T. H. Lafreniere; 2 P. J. Brown; 1 MIM Holdings Brisbane; 2 G&T Metallurgical Services Canada; 3 MET Engineers, Ltd., 2957 Bowers Place, Kamloops, BC V1S 1W5 Canada

A Dynamic Simulator for Crushing - Screening Plants: George Grundy; Cristian Araya; 1 Kvaerner E&C, Dept. of Tech., 12657 Alcosta Blvd., San Ramon, CA 94583 USA; 2 Kvaerner E & C, Dept. of Tech., Nva Tajamar 481, Santiago Chile

Plant Models for Designing Soft-Sensor and Control Models: Guillermo D. González; 1 Ricardo Barrera; 3 Aldo Casali; 2 Gianna Vailebuxona; Rafael Odgers; 1 University of Chile, Dept. of Elect. Eng., Tupper 2007, Santiago Chile; 2 University of Chile, Dept. of Mining Eng., Tupper 2006, Santiago Chile

Development Of an “On-line” Eh-ph Electrochemical Sensor for the Flotation Process Control: Christian C. Hecker; Ernesto B. Beas; 1 Universidad de Concepcion, Dept. de Ingenieria Metalurgica Chile; 2 UGA - MINCO, Division El Teniente, Codelco-Chile, Chile

Plant-Wide Control for the Collahuasi Project: Matthias Bolliger; 1 ABB Industrie AG, IBAX, Segelhofstrasse, Baden-Dättwil 5405 Switzerland

Improvement in Crushing Plant Control in Copper Mining: Christian Ottgren; 1 Svedala, Malmo Sweden

HYDROMETALLURGY

Coordinators: Sharon Young, BHP Copper, 7400 N. Oracle Rd., Suite 200, Tucson, AZ 85704; David Dreisinger, University of British Columbia, 309-6350 Stores Rd., Vancouver, B.C. V6T 1Z4, Canada; Guillermo Ugarte, Ingeniero Investigador Senior, MOLYMET, Huerfanos 812, Piso 6, Santiago, Chile

Leaching

Recent Changes to Operating Practices at Minera Quebrada Bianca: Henry Solomon-De-Friedberg; 1 Compaa Minera Quebrada Bianca S.A.

Enhanced Leaching of Copper Sulfide Leach Dumps: Application at Cananea: Jose Hector Figueroa; 1 Mexicana de Cananea, Cananea, Sonora Mexico

Heap Leaching Practices at San Manuel Oxide Operations: Joel K. Wir; 1 Phil E. Cantrell; 1 Manuel P. Neira; 1 San Manuel Operations, 28255 W. Redington Rd., P.O. Box M, San Manuel, AZ 85631 USA

Leach/Solvent Extraction/Electrowinning of Copper - World Operating Data: William G. Davenport; Jackson Jenkins; Brian D. Kennedy; 1 University of Arizona, Dept. of Mats. Sci. and Eng., Tucson, AZ 85721 USA; 2 Cyprus Sierrita Corporation, 6200 W. Duval Mine Rd., P.O. Box 527, Green Valley, AZ 85622-0527 USA; 3 Simons Engineering, Inc., 2700 N. 3rd St., Suite 4000, Phoenix, AZ 85004 USA; 4 CTI ANCOR, 2121 San Jacinto St., Dallas, TX 75201 USA

On-Line Chemical Analysis of Copper, Chloride and Acid in Copper Oxide Leachate: Enrique Acuña; Miguel Salinas; Sergio Prado; 1 Alford Fussa; 1 Codelco, Salvador Division, Santiago Chile; 2 Taylor Controls, Ltd., Providencia, Santiago Chile; 3 In Motion, Providencia, Santiago Chile; 4 Ionics, Inc., Watertown, MA USA

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Process Development Studies by Dynatec for the Recovery of Copper from Chalcocite Ore: Michael J. Collins; Tao Xue; Felix de Kok; Manher Makwana; Dynatec Corporation, Metall. Tech. Div., 8301-113 St., Fort Saskatchewan, Alberta T8L 4K7 Canada

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Interpretation of the Recovery/Time Curve and Scale-Up from Column Leach Tests on a Mixed Oxide/Sulfide Copper Ore: Ronald J. Roman; Jose Hector P. Figueroa; Jorge Helleon; Jorge Enrique H. Ruiz; Leach, Inc., 4741 N. Placita del Sol, Tucson, AZ 85749 USA; Mexicania de Cananea S.A. de C.V., Av. Juarez C.P. 84620, Cananea, Sonora Mexico; Mexicania de Cobre, Plante SXED, Nacozari, Sonora Mexico


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Design Modification at Zaldivar to Reach Plant Capacity Production: J. Hlius; J. Binvignat; C. Garcia; J. Whittaker; Comipa Minera Zaldivar, Balmaceda #2536, 4th Floor, Don Guillermo Bldg., Antofagasta Chile

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Advanced Cast Stainless Steels for Copper Industry Plants: Arto K. Riihimaki; Ahlstrom Pumps Corporation, Karhula Finland

VSF SX Developments and Operational Experiences: Bjar Nyman; Esa Lindell; Petri Taipale; Juhani Lyyra; Timo Saarenpää; Raimo Kuusisto; Outokumpu Research Oy, Kuparitie 5, P.O. Box 60, Por displaced by 28101 Finland; Outokumpu Engineering Contractors Oy, Rihtinontuntie 7E, P.O. Box 862, Espoo 02201 Finland; Outokumpu Engineering Services Oy, Rihtinontuntie 7E, P.O. Box 863, Espoo 02201 Finland; Indepro Ingenieria Ltda, Gandellarlas #265, P.O. Box 13255, Santiago de Chile, Chile

Ahlstrom Pumps - Advanced Pumping Solutions for The Copper Industry: Jouni J. Lehtinen; Ahlstrom Pumps Corporation, Basic Metal and Fertilizer Industries, Karhula FIN-48601 Finland

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Copper Bioleaching: State-of-the-Art: Corale L. Brierley; James A. Brierley; 1Brierley Consultancy LLC, P.O. Box 260012, Highlands Ranch, CO 80163 USA; 2Newmont Metallurgical Services, 1010 East Dry Creek Rd., Englewood, CO 80112 USA

Ferrous Promoted Chalcopyrite Leaching: Naoki Hiroyoshi; Tsuyoshi Hirajima; Masami Tsunekawai; 1Hokkaido University, Graduate School of Engineering, Kita 13, Nishi 8, Sapporo, Hokkaido 060-8628 Japan

Bioleaching of Primary and Secondary Copper Sulfides: J. R. Budden; H. E. Urubúa; B. J. Sabacky; P. C. Duyvesteyn; 1BHP Center for Minerals Technology, 204 Edison Way, Reno, NV 89501 USA

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A Statistical Approach Study of Copper Electrowinning Parameters: Damir Valic; 1Laurentian University, School of Eng., 935 Ramsey Lake Rd., Sudbury, Ontario P3E 2C6 Canada

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Modelling and Simulation of Copper Electrowinning: Hossein Aminian1; Claude Bazin1; Daniel Hodouin1; 1Laval University, Dept. of Mining and Metall., Ste-Foy, Quebec G1K-7P4 Canada

Application of a Two Phase Hydrodynamic Modeling to an Electrowinning Cell: Andreas Filzweiser1; Klaus Hein1; Peter Paschen1; Herwig Grogger1; 1University of Leoben, Dept. of Nonferrous Metall., Franz-Josef-Strasse 18, Leoben, Styria A-8700 Austria; 2AVL List GmbH, Hans-List-Platz 1, Graz, Styria A-8700 Austria

Modelling of the Aqueous Speciation in Acidic Cupric Sulfate Solutions: J. M. Casas1; G. Crisostomo1; F. Alvarez1; 1Universidad de Chile, Depto. Ingenieria de Minas, Tupper 2069, Santiago Chile; 2Universidad de Chile, Depto Ingenieria de Minas, Tupper 2069, Santiago Chile; 3Universidad de Santiago, Depto Intenieria Metalurgica, Av.B O’Higgins 3363, Santiago Chile

Mine Site Production of Value Added SX/EW Copper Products - The Alternative to Cathode: Stephen J. Kohut1; Mark D. Precup1; John Stephen J. Kohut1; 1Eichrom Industries, Inc., Hydrometallurgy, 8205 S. Cass Ave. Ste. 107, Darien, IL 60561 USA; 2University of British Columbia, Vancouver, British Columbia Canada; 3Straits Resources, NSW Australia; 4Nifty Copper, WA Australia

Electrolytic Copper Refining - World Tankhouse Operating Data: William G. Davenport1; Jackson Jenkins1; Brian D. Kennedy1; Tim Robinson1; 1University of Arizona, Mines Bldg. #12, Dept. of Mats. Sci. and Eng., Tuscon, AZ 85721 USA; 2Cyprus Sierrita Corporation, 6200 W. Duval Mine Rd., P.O. Box 527, Green Valley, AZ 85622-0527 USA; 3Simon Engineering, Inc., 2700 N. 3rd St., Suite 4000, Phoenix, AZ 85004 USA; 4CTI Ancor, 2121 San Jacinto St., Dallas, TX 75201 USA

The Most Recent Copper Refinery in the World: R. Manuel Ramos1; 1Mexicana de Cobre, P.O. Box 20, Nacozari, Sonora CP-84340 Mexico

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Design, Start-Up and Operation of the Cyprus-Miami Copper Refinery: Jim Garvey1; Bernard J. (Bert) Ledeboer1; James M. Lommen1; 1Cyprus Miami Mining Corporation, P.O. Box 4444, Claypool, AZ 85532 USA; 2Electrometallurgical Consultant; 3Fluor Daniel Mining and Minerals Engineering S.A., Rue Du BosQuet, 4, Louvain-La-Neuve B-1348 Belgium

The Red Metal of Amarillo: Retta M. Cunningham1; Weldon D. Read1; George A. Herring1; Abbas Mirza1; Harry E. Tallett1; 1Amarillo Copper Refinery, P.O. Box 30200, Amarillo, TX 79120 USA; 2Technical Services Center, Salt Lake City, UT USA

Recent Experiences and Tendencies at the Ventanas Electrolytic Refinery: Rodrigo F. Abel1; Nelson R. Cornejo1; Enrique C. Correa1; 1Fundicion y Refineria Ventanas - ENAMI, Carretera F-30 E N 58270, Ventanas, Comuna Puchuncavi, V Region Chile

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Tankhouse Expansion and Modernization of Copper Refineries, Ltd., Townsville, Australia: Bob Edmonds1; John Hartland1; Trevor Botha1; Laurie Adcock1; Brendan O’Rourke1; 1Copper Refineries Pty, Ltd., Hunter St., P.O. Box 5484 MC, Townsville, QLD 4810 Australia

Improvements in the Tankhouse of the Tamano Smelter: Ryuji Onizuka1; 1Kyodou Smelting Co., Ltd., Tamano Smelter, Hibi, Tamano City, Okayama Pref., Japan

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Support Systems for Organised Employee Teams: J. W. Holzhalter; M. E. Yarish; Phelps Dodge Refining Corporation, P.O. Box 20001, El Paso, TX 79998 USA

Current Efficiencies at High Current Density for Various Cathode Cycles: Ivan Marcelo Santos Moraes; Caraba Metais S.A., Technology, Via do Cobre n 3700 A.O.V. - Copec, Dias D’Avila, Bahia 42-850-000 Brazil

Anode Production

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Antimony Removal by Ion Exchange in Chilean Tankhouses at a Pilot Plant Scale: J. E. Guzman; Juan C. Salas; Enrique Roman Espinoza; S. Muto; Codelco-Chile; Instituto de Innovacion en Minería y Metalurgia, S. A. Filial Codelco-Chile, Avda. del Parque 4980 ler piso Ciudad Empresarial del Huechuraba, Santiago Chile; Mesco, Inc., Japan

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A Mineralogical Study of Nodulated Copper Cathodes: J. E. Dutrizac; T. T. Chen; CANMET, 555 Booth St., Ottawa K1A 0G1 Canada

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Reactions at the Anodes and Cathodes

Anodic Slimes Characteristics and Behaviour in Electrolytic Copper Refining: Gerardo Cifuentes; S. Hernandez; P. Navarro; J. Simpson; C. Reyes; A. Naranjo L. Tapia; Rodrigo F. Abel; Nelson R. Cornejo; Enrique C. Correa; Universidad de Santiago de Chile, Depto. de Ingeniería Metalúrgica, Av. Lib. B.O’Higgins 3363, Santiago Chile; Fundicion y Refineria Ventanas - ENAMI, Carretera F-30 E N 58270 Ventanas, Comuna Puchuncavi, V Region Chile

A Mineralogical Study of the Depokment of Impurities During the Electrowinning of Secondary Copper Anodes: T. T. Chen; J. E. Dutrizac; CANMET, 555 Booth St., Ottawa K1A 0G1 Canada

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Nucleation and Initial Stages of Growth of Copper Electrodeposited on Anodized 304 Stainless Steel: Melania Urda-kiel; Jean-Luc Delplacec; Liviu Onciuc; René Winand; University Babes-Bolyai, Dept. of Phys. Chem., Cluj-Napoca 3400 Romania; Universite Libre de Bruxelles, Dept. of Metall. & Electrochem., CP165, 50 Ave. Roosevelt, Brussels B-1050 Belgium

PYROMETALLURGY

Operations

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Developments in Direct-to-Blister-Smelting at Olympic Dam: Arthur G. Hunt; Steven K. Day; Simon M. Cmlec; Robert C. West; WMC Resources, Ltd., Olympic Dam Operations, P.O. Box 150, Roxby Downs Australia

Modernization of the Luanshya Smelter, Zambia: A. P. Mukharjee; M. J. Morgan; C. L. Boettach; A. A. Luraechi; Roan Antacope Mining Corporation of Zambia PLO, P.O. Box 90456, Luanshya Zambia; INDEC International Engineering Consulting Services, Avda, Provincia 2653, OL, Santiago 512 Chile
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Gas Handling and Cleaning at the Potrerillos Smelter: Leonel Contreras1; Pedro Reyes1; Benjamin Martinich1; Rene Bustamante2; 1Codelco-Chile; 2Universidad de Santiago de Chile, Casilla 10233, Santiago Chile

Analysis of Sulfuric Acid Plant Gas Cooling and Cleaning Systems: Leonard Joel Friedman1; 1Acid Engineering & Consulting, Inc., 17770 Deauville Lane, Boca Raton, FL 33496 USA

Revising Copper Converter History: A Metallurgical “Whodunit?” Larry M. Southwick1; L. M. Southwick & Associates, 992 Marion Ave., Suite 306, Cincinnati, OH USA

Fugitive Emissions Control Methodology at Phelps Dodge, Chino Mines: Mike Cricillo1; Paykan Safe2; Brian Wiggins2; 1Phelps Dodge Chino Smelter, Hurley, TX USA; 2GCTx Process Technologies, Dallas, TX USA

Agglomeration of ESP Dust for Recycling to Flash Smelting Furnace: N. Smith1; P. Ryan1; K. Hudson1; 1Produs Kake, Inc., 1515 West 2200 South, Suite C, Salt Lake City, UT 84119 USA

Furnace Cooling Design for Modern, High-Intensity Pyrometallurgical Processes: N. Voermann1; Hatch Associates, 2800 Speakman Dr., Mississauga, Ontario L5K 2R7 Canada

The Utilization of Excess Reaction Heat in the Mitsubishi Converting Furnace: Osamu “Sam” Iida1; Hiroshi Kumada1; Tetsuro Sakai1; 1Mitsubishi Materials Corporation, Naoshima Smelter & Refinery, 4049-1 Naoshima-cho, Kagawa-gun, Kagawa 761-3110 Japan

Peirce Smith Converter Process and Off-Gas System Improvements at BHP Copper: Ovidiu Pasca1; John Bryant1; Paykan Safe2; Brian Wiggins2; 1BHP Copper, Inc., P.O. Box M, San Manuel, AZ 85631 USA; 2GCTx Process Technologies, 4950 North O’Connor Rd., Suite 250, Irving, TX 75062 USA

Competitiveness of the Outokumpu Flash Smelting Technology - Now and in the Third Millennium: Pekka Hanniala1; Ilkka V. Kojo1; Aimo Kurki1; 1Outokumpu Engineering Contractors Oy, P.O. Box 862, Espoo FIN 02201 Finland

Development of New Bath Smelting Technology at Mines Gaspe: B. Langlois1; Mines Gaspe, Murdochville, Quebec G0E 1W0 Canada

New Strategic Scope of the Caletones Smelter Development: Ruben Alvarado1; Jorge Codoy1; 1Caletones Smelter, Div. El Teniente, Codelco-Chile, Chile

Modification of the Mount ISA Copper Smelter to Feed a New Sulphuric Acid Plant: Richard Hollis1; Adrian Werny2; Greg Yeowart2; 1Flour Danikels Pty., Ltd., Brisbane, Qld Australia; 2Mount Isa Mines, Ltd., Brisbane, Qld Australia

First Year of Industrial Operation of the Noranda Continuous Converter: R. Lapointe1; M. Zamalloa1; 1Noranda Inc., Horne Smelter, C.P. 4000, Rouyn-Noranda, Quebec J9X5B6 Canada; 2Noranda Technology Center, 240 Hymus Blvd., Pointe Claire, Quebec Canada

Teniente Converter Slag Cleaning Using and Electric Furnace at Las Ventanas Smelter: Ricardo Ponce1; Gerado Sanchez1; 1Empres de Mineria, Las Ventanas Smelter, Casilla 126-B, Quintero Chile


Expansion of Onsan Smelter: Seong-won Kang1; Han-young Jo1; Jeong-ha Lee1; Jeong-ju Lee1; 1LG Metals Corporation, 70 Daejung-ri, Onsan, Ulju, Ulsan 689-890 Korea

Converter Operation at BHP San Manuel Smelter: T. W. Gonzales1; D. Nashall1; O. D. Pasca1; R. David1; 1BHP Copper, Box M, San Manuel, AZ 85631 USA

Use of Optical On-line Production Control in Copper Smelters: Wilhelm Wendt1; Willy Persson1; 1Semtech Metallurgy AB, Ideon, Lund S-223 70 Sweden

Recent Operation of the Flash Smelting Furnace at Saganoseki Smelter: Yoshihiro Hira1; Yutaka Yasuda1; Yoshiaki Suzuki1; Mitsumasa Hoshi1; 1Saganoseki Smelter & Refinery, Nippon Mining & Metals Co., Ltd., Saganoseki, Oita 879-2201 Japan

Technical Improvement and Modification of Guixi Smelter in Recent Ten Years: Yuan Zeiping1; 1Guixi Smelter of Jiangxi Copper Company, P.O. Box Ye Jing Rd., Jiang Xi Province 335424 China

Secondary Copper

Optimisation of Blast Furnaces and Converter Processes in a Secondary Copper Smelter: Andreas Notte1; Ralf Kreymann1; 1Huttenwerke Kayser AG, Kupferstrasse 23, Lunen, Postfach D-44532 Germany

The Application of Copper Metallurgy in the Recycle of Precious Metals: Corby G. Anderson1; Todd Fyram1; 1CAMP, Dept. of Eng., Butte, MT 59010 USA

Chile and the Application of the Basel Convention: G. E. Lagos1; 1Catholic University of Chile, Santiago Chile

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Chile and the Application of the Basel Convention: G. E. Lagos1; 1Catholic University of Chile, Santiago Chile

Copper Recycling and the Environment: G. E. Lagos1; M. E. Andia1; 1Catholic University of Chile, Santiago Chile

Problems in Secondary Copper Metallurgy and Solution Proposals: Peter Paschen1; Jorg Wallner1; 1University of Leoben, Montanuniversitat Leoben, Franz-Josef, Strafe 18 Austria; 2Metallwerke Brixlegg Austria

Copper Scrap Movements and the International Copper Scrap Industry: Robert A. Stein1; 1Louis Padnos Iron & Metal Company, P.O. Box 1979, Holland, MI 49422-1979 USA
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Fundamentals, Process Modeling, Technology and Development

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High Oxygen Shrouded Injection at Falconbridge Converters: A. Bustos1; B. Macnamara1; J. Kapusta1; M. Coffin2; 1Air Liquide Canada Inc., 1250, Boul. Rene Levesque Ouest, Bureu 1700, Montreal, Quebec H3B 5E6 Canada; 2Falconbridge, Ltd., Falconbridge, Ontario Canada

Thermochemical Modeling of Smelting Operations: Alastair L. Davies1; John F. Castle1; John A. Gisby2; Marielle A. S. Siria2; Philip J. Gabb1; A. J. Weddick1; 1Rio Tinto Technical Services, P.O. Box 50, Lower Castle St., Castlemead, Bristol BS99 7YR UK; 2National Physical Laboratory, Centre for Mats. Measure. and Tech., Queens Rd., Teddington, Middlesex TW11 0LW UK; Kenneecott Utah Copper, Smelter, 12000 West 2100 South, Magna, UT 84044 USA

Application of Composite Furnace Module Cooling Systems in a Flash Furnace Reaction Shaft: Andrew K. Kyllo1; Diamond Papazoglou2; Neil B. Gray1; 1The University of Melbourne, Dept. of Chem. Eng., Parkville, Vic 3052 Australia; 2Western Mining Resources, Ltd., Kalgoorlie, WA 6430 Australia

Databases and Software for Thermodynamic Simulations of Copper Smelting and Converting: Sergei Degertov1; Arthur D. Pelton1; Florian Kongoli2; Manuel Zamalloa2; 1Ecole Polytechnique, Dept. of Metall. Eng., P.O. Box 6079, Station “Downtown”, Montreal, Quebec H3C 3A7 Canada; 2Noranda Technology Center, 240 Hymus Blvd., Pointe Claire, Quebec H9R 1G5 Canada

Alkaline Leaching of Arsenic from Smelter Flue Dust and Leaching Solution Segregation: Antelmo V. Robles1; Ana E. I. Serna1; 1 Rio Tinto Technical Services, P.O. Box 448, Espoo FIN-02201 Finland; 2Outokumpu Research Oy, P.O. Box 60, Espoo FIN-02015 Finland; 3Outokumpu Engineering Contractors Oy, P.O. Box 6200, Espoo FIN-02015 Finland

Conveter and Bath Smelter Vessel Design - Blast Delivery and Tuyers Performance: A Re-assessment of Design Characteristics: A. W. Wraithphil1; P. J. Mackey1; 1University of Newcastle, Dept. of Mech., Mats. and Manuf. Eng., Newcastle upon Tyne NE1 7RU UK; 2Noranda Technology Centre, 240 Hymus Blvd., Pointe Claire, Quebec Canada

Factors Determining the Efficiency of Copper Removal from a Highly Oxidized Slag in an Electric Furnace: A. Warczok1; G. Riveros1; C. Diaz2; P. Echeverria1; H. Schwartz2; G. Sanchez2; 1Universidad de Chile, Dept. de Ingenieria de Minas, Santiago Chile; 2El Teniente Division, Codelco-Chile, Caleton Chile; 3ENAMI, Santiago Chile; 4Fundicion Ventanas, ENAMI Chile

Mathematical Modeling of the El Teniente Slag Cleaning Process: A. Warczok1; G. Riveros1; C. Diaz2; D. Cordero2; 1Universidad de Chile, Dept. de Ingenieria de Minas, Santiago Chile; 2Codelco-Chile, El Teniente Division, Caleton Smelter Chile

Ferrous Calcium Silicate Slag to Be Used for Copper Smelting and Converting: Akira Yacawa1; Yoichi Takeda1; Shigeatsu Nakazawa1; 1Tohoku University, 2-1-1 Katahira, Sendai 980 Japan; 2Iwate University, Morioka Japan

Activity Measurement of Minor Elements in Cu-S-Me (Me=Ag, Se, Te) and Cu-Fe-S-Me Matte Systems at 1473 K by Mass Spectrometric Method: Alireza Zakeri1; Mitsuhisa Hino1; Kimio Itagaki2; 1Tohoku University, Institute for Advanced Mats. Proc. (IAMP), 2-1-1 Katahira, Aoba-ku, Sendai, Miyagi-ken 980-8577 Japan

Application of a Reacting CFD Model to Drop Tube Kinetics and Smelter Simulations: B. R. Adams1; K. A. Davis1; M. P. Heap1; A. F. Sarofim2; G. A. Eltringham2; A. A. Show2; 1Reaction Engineering International, 77 West, 200 South, Suite 210, Salt Lake City, UT 84101 USA; 2BHP Copper, P.O. Box M, San Manuel, AZ 85631 USA

Computerized Fluid Dynamic (CFD) Modeling, an Important New Engineering Tool for Design Smelting Furnaces: Brigett M. Rosendall1; D. Michael Lane1; Jonathan M. Berko1; 1Bechtel Corporation, Mining & Metals Technology, P.O. Box 193965, San Francisco, CA 94119-3965 USA

Effect of ZnO, CuS and CaO on Viscosity: C. M. Acuna1; J. Jara1; C. Hu1; F. Parada1; 1Chuquicamata Division, Codelco-Chile, Chile; 2Universidad de Concepcion, Depto. Ingenieria Metalurgica, Concepcion Chile

Sampling the Shaft of the Olympic Dam Copper Flash Furnace: D. N. Collins1; F. R. A. Jorgensen1; W. J. Rankin1; 1CSIRO Minerals, P.O. Box 312, Clayton South, Vic 3169 Australia

Slag Chemistry of the New Noranda Continuous Converter: E. Carissimi1; M. Zamalloa2; 1Noranda Inc., Horne Smelter, C.P. 4000, Rouyn-Noranda, QC J9X 5B6

Laboratory Reduction of Copper Slag by Graphite Electrodes Using Direct and Alternating Current: Eric John Grimsey1; Ismail Dal1; Nan Li1; 1WA School of Mines - Curtin University, PMB 22, Kalgoorlie, WA 6430 Australia

Behaviour of Copper Matte Particles in Suspension Oxidation: Esa J. Peuraniemi1; Ari Jokilaakso1; Juha Jarvi1; 1Helsinki University of Technology, Lab. of Mats. Proc. and Powder Metallurgy, P.O. Box 6200, Espoo FIN-02015 Finland; 2Outokumpu Engineering Contractors Oy, P.O. Box 862, Espoo 02201 Finland; 3Outokumpu Research Oy, P.O. Box 60, Pori FIN-28101 Finland

Automatic Quantitative Mineralogy Applied to Copper Slags: E. A. Siegel1; P. D. Siegel1; 1University of Chile, Dept. of Mining Eng., Chile

Numerical and Experimental Modeling of the Concentrate Burner in a Flash Smelt Furnace: F. Guevara1; A. Valencia1; R. Fuentes1; 1Codelco-Chile, Institute for Innovation in Mining and Metallurgy (IM2), Avenida del Parque 4980, Ciudad Empresarial, Hucchuraba Santiago, Chile

The Effect of Minor Components and Flux Additions on the Liquidus Temperatures of the Multi-Component Iron Silicate Slags: Florian Kongoli1; 1Flogen Technologies, P.O. Box 49529, C.P. Du Muse, Montreal, Quebec H3T2A5 Canada

A Waterless Caster for Matte/Slag Granulation: Frank Mucciardi1; Enzo Palumbo1; Ning Jin1; 1McGill University, Dept. of Metall. Eng., 3610 University, Montreal, Quebec H3A 2B2 Canada; 2Noranda Technology Centre, 240 Hymus Blvd., Pointe Claire, Quebec H9R 1G5 Canada

Extending Lance Life in Top Blowing: Frank Mucciardi1; Ning Jin1; 1McGill University, Dept. of Metall. Eng., 3610 University, Montreal, Quebec H3A 2B2 Canada

Technology for Decreasing Refractory Wear on Mitsubishi Process: Fundamental Researches and Their Applications: Fumito Tanaka1; Hideya Sato1; Nozomu Hasegawa1; 1Mitsubishi Materials Corporation, Central Research Institute, 1-297 Kitabukuro-cho, Omiya, Saitama 330-8508 Japan

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A Non-Linear Mathematical Model of a Copper Flash Smelting Furnace: V. M. Sanchez; Pedro Flores; Jose Adolfo Valera; 1Universidad de Sonora, Depto. de Ingeniería Química y Metalurgia, Calle 3 y Ave. 4 #86, Fracc. Bugambilias, Hermosillo, Sonora CP 83140 Mexico; 2Universidad de Sonora, Depto. de Matemáticas, Rosales y Luis Encinas, Colonia Centro, Hermosillo, Sonora 83000 Mexico; 3Universidad de Sonora, Depto. de Ingeniería Química, Rosales y Luis Encinas, Colonia Centro, Hermosillo, Sonora 83000 Mexico

Copper Solubility in SiO₂-CaO-FeOₓ Slag Equilibrated with Matte: Yoichi Takeda; 1Iwate University, Dept. of Mats. Sci. and Eng., 4-5-3 Ueda, Morioka 020-8551 Japan

ENVIRONMENT & SAFETY

Coordinators: Melinda R. L. Pon, BHP Copper Inc., 550 California St., San Francisco, CA 94104-1020; Hans Gopfert, Chile

The Role of Ecosystem Management in Resolving Environmental Issues for Multinational Mining Companies: Douglas P. Reagan; 1URS Greiner Woodward-Clyde, 4582 South Ulster St., Suite 1000, Denver, CO 80237 USA

The Use of Gracilaria Chilensis Biomass for Heavy Metals Adsorption in a Mining Waste Water: F. Riut; M. Sanchez; F. Vergara; 1Universidad de Concepcion, Edmundo Larenas 270, Dept. of Metall. Eng., Concepcion Chile

Tailings Impoundments Management of The Zambian Experience: G. M. Beene; P. Chisanga; A. Mpishil; 1Nikana Smeltra, Dept. of Metall., Kitwo, Zambia

The Development of Environmental Regulations in Poland and its Influence on the Copper Industry: Helena Byrdziak; Jerzy Dobrzarski; Jan Garbaczewski; 1KGHM Polska Miedz S.A., 59-300 Lubin, ul. M. Skjodowskiej 48 Poland

Selecting an Economical and Safe Tailings Disposal System: Han Ilhan; Peter Stauffer; Ely Robinsky; Pedro Repetto; 1URS Greiner Woodward-Clyde, 4582 South Ulster St., Suite 1000, Denver, CO USA; 2E.I. Robinsky Associates, Ltd., Toronto Canada

Uptake of Copper from Extremely Dilute Aqueous Solutions by Alginate Sorbent Material: An Alternative for Environmental Control: Ibanez Juan Patricio; Umetsu Yoshiaki; 1Tohoku University, Institute for Adv. Mats. Proc., Katahira 2-1-1, Aoba-ku, Sendai, Miyagi-ken 981-8577 Japan

Human Health Assessment: An Ever-Moving Target: Jenifer S. Heath; 1URS Greiner Woodward-Clyde, 4582 South Ulster, Suite 1000, Denver, CO 80237 USA

Hernan Videla Lira Copper Smelter Fulfillments of Environmental Regulations: Jose Sanhueza; Orlando Rojas; Ariel Balocchi; 1Empresa Nacional De Mineria, Paipote Chile

Development and Implementation of a Common International System for Safety and Health Management at Corporate Mining Operations: Kyle B. Dotson; 1BHP Copper, Dept. of Safety, Health and Environ., 550 California St., 5th Floor, San Francisco, CA 94104 USA

Potential Use of Electron Beam Irradiation for SO2 Abatement from Diluted Metallurgical Off-Gases: Loreto Villanueva; Luis Ahumada; 1Commission Chilena de Energia Nuclear, Santiago Chile
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