TMS2003

SHORT COURSE

132nd Annual Meeting & Exhibition

Yazawa
International
Symposium on

METALLURGICAL AND MATERIALS PROCESSING:

Principles and Technologies

In conjunction with
the 132nd TMS Annual Meeting & Exhibition

March 1-2, 2003

San Diego, California USA

Sulfide Smelting: Principles, Technologies, and Environmental Considerations
Saturday, March 1, 2003 • 8:30am-5:00pm
Sunday, March 2, 2003 • 8:30am-12:00pm

Presented by:
Hong Yong Sohn, Professor, University of Utah, USA
Kimio Itagaki, Professor, Tohoku University, JAPAN
Florian Kongoli, Executive President,
FLOGEN Technologies Inc., CADADA

Who Should Attend

This 2 day course is intended for managers, supervisors, engineers and scientists employed in either research or operations associated with sulfide smelting. This short course is also highly recommended to current students interested in learning about chemical processes of nonferrous metal production.

Course Overview

This intensive short course will cover the basic principles involved in sulfide smelting and their practical implications, including thermodynamics and physical chemistry; efficient flux strategies and practices; slag, matte and metals properties; new ways of representing multicomponent systems; control of magnetite precipitation, furnace build-ups and active volume, refractory degradation, metal separation and recovery, effect of minor components and/or fluxes; thermochemical modeling and simulation; process control, optimization and automation; software; behavior of minor elements, fluid flow, and reaction engineering. The leading smelting processes, new technologies, and proposed future variants will be discussed, with emphasis on copper production and environmental issues. The beneficial effect of the new, environmentally friendly technologies on the competitiveness of the metal industry of industrialized nations will be discussed. The course will be concluded by a discussion of the future of the smelting industry with audience participation.

Prposed Course Outline

1. Thermodynamic Principles of Sulfide Smelting
   - 1.1 Basic thermodynamic principles: Potential diagrams, activity, and activity coefficient
   - 1.2 Matte and Metal Properties: Liquidus surface, matte grade, minor components
   - 1.3 Practical application

2. Slags and Fluxes
   - 2.1 Basic information
   - 2.2 Phase diagrams and liquidus surface
   - 2.3 Viscosity
   - 2.4 Foaming
   - 2.5 Fluxing strategies and practices

3. Thermochemistry of Minor Elements in Sulfide Smelting
   - 3.1 Distribution ratios
   - 3.2 Nature of dissolved species
   - 3.3 Sources of data
   - 3.4 Thermodynamic modeling of minor element behavior

4. Thermochemical modeling and simulation
   - 4.1 Empirical Modeling
   - 4.2 Thermochemical and physicochemical Modeling
   - 4.3 Critical Analysis and Comparison
   - 4.4 Modeling versus experimental investigation
   - 4.5 Software
   - 4.6 Process control, optimization and automation

5. Rate phenomena in Sulfide Smelting
   - 5.1 Rate Processes
   - 5.2 Turbulent flow phenomena

6. Process Design and Mathematical Modeling
   - 6.1 Flash smelting
   - 6.2 Bath smelting

7. Industrial Practice and New and Emerging Technologies
   - 7.1 The Kennecott-Outokumpu Flash Converting Process
   - 7.2 Ausmelt/Isasmelt/Sirosmelt Process
   - 7.3 The Noranda Converter
   - 7.4 The QSL Process
   - 7.5 Other

8. Energy and Environmental Considerations

9. Discussion with audience participation
   Flash smelting vs. bath smelting; all other subjects discussed during the day

About the Presenters

H.Y. SOHN

H. Y. Sohn received his Ph.D. degree in 1970 from the University of California at Berkeley. Dr. Sohn joined the Department of Metallurgical Engineering at the University of Utah in 1974. Professor Sohn's work has been recognized through various awards, including the 2001 James Douglas Gold Medal Award (for research and education of nonferrous extractive metallurgy) from AIME, the TMS Champion H. Mathewson Gold Medal Award (1993), the TMS Extractive Metallurgy Lecturer Award (1990, in recognition as an outstanding scientific leader in the field of nonferrous extraction), the TMS Extraction and Processing Science Award (1990, for work on flash smelting; 1994; and 1999), the Fulbright Distinguished Lecturer (1983). Dr. Sohn has co-authored two monographs, co-edited 13 books, and written some 300 papers. He has served as a Director of TMS. Dr. Sohn has acquired an international reputation in the field of sulfide smelting for computer modeling and analysis of the flash smelting/converting processes as well as of the minor-element behavior. He has also worked on the analysis of a channel reactor for continuous smelting by the countercurrent contacting of slag and matte/metal phases with bottom gas injection.

K. ITAGAKI

Kimio Itagaki was born on August 04, 1943 in Tokyo. He graduated from Tohoku University, Metallugical Engineering, in March 1966, finished Master of Engineering at the same university in March 1968, was appointed Research Associate at Research Institute of Mineral Dressing and Metallurgy, Tohoku University in April 1968 and worked with Prof. Akira Yazawa to obtain Dr. Engineering Degree by Thesis at Tohoku University. In January 1976 he was appointed Lecturer and in May 1976 Associate Professor at the same institute. In April 1978 he stayed at Technical University of Aachen in Germany as a research fellow of the Alexander von Humboldt Foundation and worked with Prof. Kubaschewski and Prof. Knacke on high temperature calorimetry from 1980-1981. Since 1991, he is Full Professor of Tohoku University (1991-1992, Research Institute of Mineral Dressing and Metallurgy, 1992-2001, Institute for Advanced Materials Processing and 2001-present, Institute of Multidisciplinary Research for Advanced Materials - the institute changed the name twice). Research fields: thermochemistry of metallurgical substances, nonferrous pyrometallurgy, processing of functional alloys. Association member: TMS, GDMB (Germany), Japan Institute of Metals, Mining and Materials Processing Institute of Japan, Japan Institute of Calorimetry.

F. KONGOLI

Florian Kongoli [BSc (Honors), MScA, (U.Montreal)/MTMS, MCIM] is Executive President of FLOGEN Technologies Inc. (www.flogen.com), a technology, research and consulting company. He has about 15 years of research and development and academic (lecturer) experience spread in many long-time engagements in several continents, such as in Australia, Europe, North America and Asia. He has worked and successfully carried out many industrial research projects for several well-known companies such as, Mitsubishi, Sumitomo, Falconbridge, INCO, WMC, Noranda, to mention a few. In his pure research work he has worked and cooperated with several well-known universities around the world such as Tohoku University (Japan), Curtin University (Australia), University of Montreal (Canada), etc. His work is oriented among others in developing new low cost technologies through thermophysicochemical modeling, simulation and laboratory experimental studies applicable in various metallurgical and chemical processes in nonferrous (Ni, Cu, Zn, Pb, Fe-Ni) extraction and processing as well as in iron and steel making industry. He has published about 25 scientific articles in the last 4 years dealing with novel technological applications, modeling of multicomponent mattes, slags, metals, liquidus temperature and phase diagrams, effect of minor components, fluxing strategies etc. The results of his work and some of his databases have been used by several companies in the world. He is also author of some other 70 articles, technical reports, invited lectures and research presentations.