Sustainable Developments in Hydrometallurgical and Electrometallurgical Processing

Shijie Wang

The meaning of sustainable development is taking a long-term view and meeting the needs of today's generation without compromising the needs of tomorrow's generation. Sustainable development as a concept, as a goal, and as a movement has spread rapidly and is now featured on most major enterprises' websites and ingrained into every facet of their businesses. Nevertheless, there still exist two important questions: what is to be sustained and what should be developed? Nature, life support systems, and community, including Earth, environment, and cultures, have been identified in the literature as major and intermediate categories to be sustained.¹ Similarly, people, economy, and society need to be developed. With an emphasis on values and goals, major mining companies focus on maximizing resources and positioning themselves to take advantage of technological development, while still having sustainable development in mind with regard to profitability, safety, and operating efficiency.

Hydrometallurgy, aimed at recovering metals naturally without smelter stacks, has been advancing progressively since the breakthrough of uranium extraction in the 1940s. Solvent extraction technology was first commercially used in 1968 to replace the existing iron cementation process for the recovery of copper from low-grade copper solution obtained by leaching copper oxide ore.² The medium-temperature pressure leaching of chalcopyrite concentrates, after a significant number of different leaching tests worldwide in the past

30 years, was first commercialized in 2007.³ The construction of a new molybdenum and rhenium recovery plant that would no longer send emissions up the chimney was announced in 2008.⁴ These technology developments will have a lasting impact on the future of mining companies.

This *JOM* issue contains five papers that present sustainable developments in hydrometallurgical and electrometallurgical processing. In these papers specific attention is paid to sustainable development concepts, efforts, and progress. Some of the described efforts are still far from being financially viable, and considerable R&D is needed to bring about a new paradigm in the recovery of metals.

In "The Electrochemical Recovery of Metallic Palladium from Spent Electroless Plating Solution" Nathan Warner and Michael Free investigate the recovery of the remaining palladium in the waste solution by means of electrochemical deposition onto a cylindrical porous mesh copper cathode in a system called the Gold Bug®. This paper finds that about 90% of the palladium in solution was recovered in 10 hours and 20 hours at 10 amps and 5 amps, respectively.

"Leaching of Natural Stibnite using Sodium Hydroxide Solution" by Emilla Smincakova presents the results of an experimental investigation that was focused on the effects of liximate concentration, temperature, and grain size of the solid phase. Activation energy and apparent order of stibnite reaction were $E_a \sim 50.97$ KJ/mol and $n \approx 1$, respectively.

Aimed toward minimizing waste emissions and reducing energy consumption, Dimitrios Filippou and Guillaume Hudon's paper "Iron Removal

and Recovery in the Titanium Dioxide Feedstock and Pigment Industries" describe that titanium is regularly associated with iron in nature and recovered iron can be a significant byproduct of titanium extraction. This paper reviews new processes currently under development. Clearly the way to overcome some economic and environmental problems is through sustainable development.

In "Technical and Business Considerations of Cobalt Hydrometallurgy" Edgar Peek, Torjus Akre, and Edouard Asselin discuss the cobalt process requirements up and downstream as well as the technical and commercial challenges associated with each chosen method. In particular, they describe some of the environmental and energy implications of each process.

With the exception of comminution, F. Parada and E. Asselin's paper "Reducing Power Consumption in Zinc Electrowinning" declares that electrowinning is the largest power-consuming unit in hydrometallurgical processing. Since power consumption is directly proportional to electrolytic cell voltage, this paper reviews factors affecting power use and summarizes the alternative anode reactions that could lead to reduced power consumption in zinc electrowinning.

References

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3. S. Wang, *JOM*, 60 (7) (2005), p. 40.
4. A. Choate-Nielsen, *Deseret News* (11 June 2008), www.deseretnews.com/article.

Shijie Wang is with Kennecott Utah Copper Corp. in Magna, Utah and is the advisor to *JOM* from the Hydrometallurgy and Electrometallurgy Committee of the Extraction & Processing Division of TMS.