

**June 16, 2005**

## **SMM NEWS RELEASE**

### **SMM DEVELOPS NEW HYDROMETALLURGICAL COPPER REFINING PROCESS**

Sumitomo Metal Mining Co., Ltd. (SMM: Minato-ku, Tokyo/ President: Koichi Fukushima) has succeeded in developing a new technology for refining copper. The new technology uses a hydrometallurgical technique to process chalcocopyrite concentrate, the mineral that comprises more than 90% of copper ore. It was developed at SMM's Niiyama Research Laboratories (Niihama City, Ehime Prefecture), and its viability has been confirmed through continuous testing at a pilot plant.

Today, refining of chalcocopyrite concentrate is carried out almost exclusively using pyrometallurgical methods. However, with pyrometallurgical type refining an array of environmental and operational concerns must be addressed, including the elimination of pollutants in the sulfurous acid gas emitted during smelting at high temperatures and handling of the high-temperature melt. To overcome these demands, today attention is focusing on hydrometallurgical refining methods, and some processes have already been implemented in pilot tests or gone into operation on commercial scale.

The hydrometallurgical refining methods that presently exist are fraught with numerous disadvantages, however. 1) Production costs are higher than with pyrometallurgical refining. 2) The methods currently available must be used in tandem with existing processes. 3) The iron contained in the chalcocopyrite concentrate is chemically less stable than the slag produced with pyrometallurgical refining, because it is recovered as goethite (iron hydroxide:  $\text{FeOOH}$ ) or hematite (iron oxide:  $\text{Fe}_2\text{O}_3$ ); moreover, it is generated in large quantities. 4) The recovery rate of precious metals is low.

Heap leaching + solvent extraction electrowinning (SX-EW) is a highly effective method that enables hydrometallurgical processing of copper ore; however, this method is unable to process the chalcocopyrite ore that makes up a large proportion of copper ore.

Accordingly, today processing chalcocopyrite ore is chiefly carried out by first converting it to chalcocopyrite concentrate by flotation and then performing pyrometallurgical refining, or alternately by partial small-scale hydrometallurgical refining (see the accompanying reference material).

The hydrometallurgical copper refining process newly developed by SMM makes use of the company's chlorine refining technology perfected for matte chlorine leach electrowinning (MCLE), a process originally developed for nickel refining that boasts many years of proven success. Application of this technology to copper refining has not only enabled processing of chalcocopyrite concentrate, but also significantly improved reaction efficiency and yielded numerous advantages.

The major features of SMM's new technology are as follows:

1. Copper leaching by chlorine

Among the hydrometallurgical refining methods revealed until now, many employ a method whereby copper is leached using sulfuric acid. With the process newly developed by SMM, chalcocopyrite concentrate is leached using chlorine. With solution obtained through chlorine leaching, the copper can be handled as monovalent ions. Moreover, compared to sulfuric acid leaching in which copper is electrolytically reduced from bivalent ions, with chlorine leaching copper metal can be recovered using a small amount of energy. In addition, whereas hydrometallurgical refining of chalcocopyrite concentrate employing sulfuric acid is performed in a pressurized environment, with the new method developed by SMM chlorine leaching is carried out under atmospheric pressure. The new method thus eliminates the need for pressurized reaction equipment, which is both costly and demands sophisticated maintenance skills. As a result, the new method substantially boosts cost competitiveness and greatly facilitates equipment handling.

2. Recovery of iron as metal

Instead of recovering the iron in the chalcopyrite concentrate as slag or goethite/hematite wastes, SMM's method is the first in the world that enables recovery as metal. The metal can be sold as metal, and thereby enables higher economy in the overall process.

### 3. Processing of wide array of copper ores

Among the various concentrates of copper ores, the new process offers versatility for application not only with chalcopyrite concentrate, leaching of which requires highly advanced technologies, but also a wide array of copper ore concentrates.

### 4. Enhanced cost competitiveness

With SMM's new process, construction of refineries to process chalcopyrite concentrate is expected to be equal to or cheaper in cost than with pyrometallurgical type refining or the other hydrometallurgical methods revealed to date. Operating costs are also equivalent or less. And as further improvements to the process are achieved going forward, overall cost competitiveness on a par with that of type refining is anticipated. Furthermore, in light of the hydrometallurgical method's advantages over pyrometallurgical refining with respect to environmental and operational aspects, demand for the new process should heighten even further in the coming years.

### 5. Effective recovery of precious metals

With the hydrometallurgical chalcopyrite concentrate processing methods revealed to date, recovery of precious metals is reported to be poor. With SMM's newly developed process, use of highly reactive and environmentally compatible agents enables highly efficient recovery of precious metals.

Today SMM is taking aggressive measures to achieve its strategic goal of joining the ranks of major nonferrous metal producers 10 years down the road. Those measures include the search for and acquisition of outstanding copper resources, enhancement of

copper refining capacity, and acquisition of nickel ore sources based on technological capabilities. The newly developed hydrometallurgical refining process is an integral part of that strategy, and the company intends to actively promote its adoption in new refineries to be constructed both at home in Japan and abroad.

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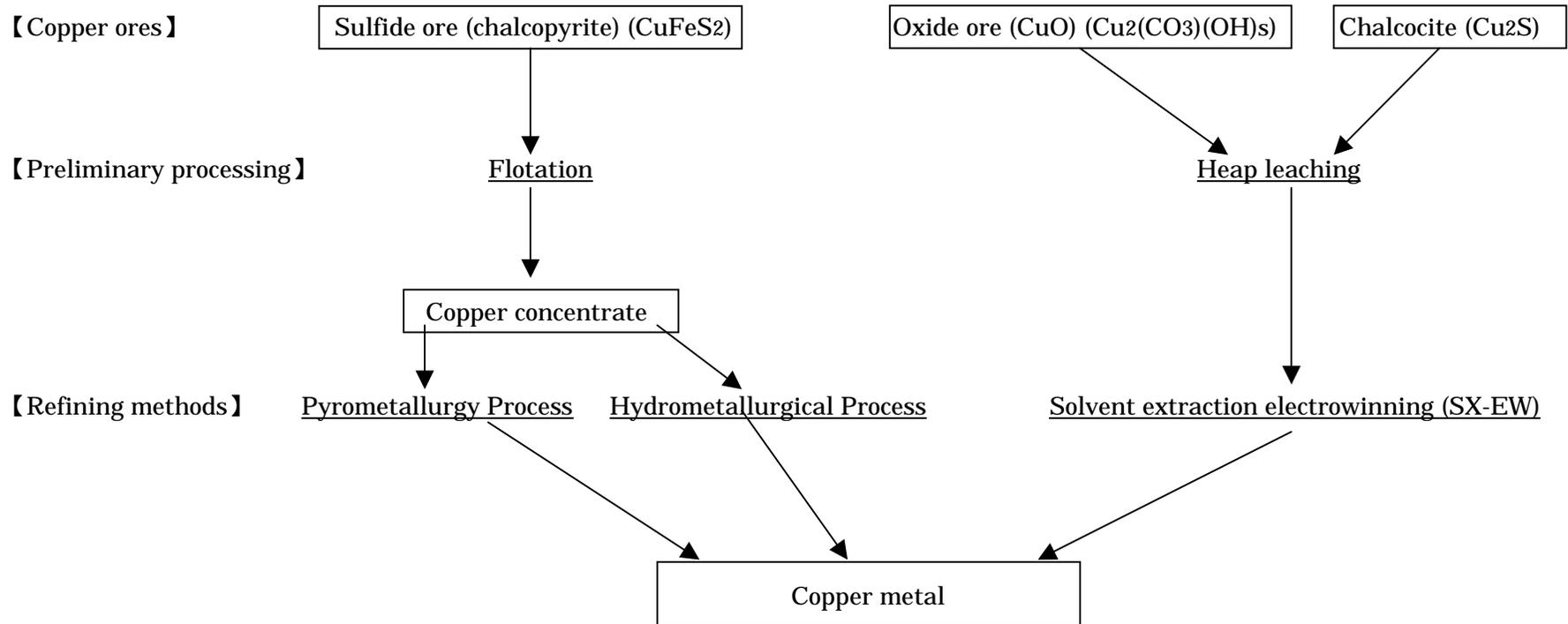
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**REFERENCE MATERIALS**

1.      Representative copper ores and refining methods
2.      New hydrometallurgical refining process (pilot plant photo: Niihama Research Laboratories)
3.      SMM's hydrometallurgical refining process: flowchart

Reference Material #1

Representative copper ores and refining process



\*1 Nearly all copper ore on Earth, more than 90%, is chalcopyrite; oxide ore, chalcocite, etc. are said to account for the remaining less than 10%.

\*2 Among the various refining methods, heap leaching + SX-EW is said to be the least expensive to operate; however, this method is unable to process chalcopyrite. For that reason, chalcopyrite is processed by flotation as copper concentrate. The method newly developed by SMM performs wet refining of copper concentrates including chalcopyrite; it also yields copper metal.

Reference Material #2

New hydrometallurgical refining process  
(pilot plant photo : Niihama Research Laboratories)



NEW HYRDOMEATTURGICAL COPPER REFINING PROCESS (Sumitomo Metal Mining)

