Self-Developed Copper Smelting Technology Brings New Opportunity for Global Copper Production

Xiao Gongming
Minmetals Copper (Hunan) Company
1. SKS process, self-developed technology in China
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Kangjiawan in Shuikoushan is the fourth largest Zinc and Lead mine in China, with a reserve of 1.4 million tons of metals. The mine is also rich in Sulfur concentrate, with a reserve of 4.5 million tons. The sulfur concentrate contains gold (5-8 g/t), which is hard to extract by normal flotation.
From 1989 to the beginning of 1992, Shuikoushan organized research teams to develop technology of “Gold Capture with coppermatte generation” by processing copper and sulfur concentrate. Shuikoushan has made a progress on it.

On Sep. 1994, a patent of “Bottom-blowing copper smelting furnace and process” was granted to Shuikoushan by National Patent Bureau.
In 1992, Shuikoushan produced 3,000 tons of copper in its Oxygen bottom-blowing smelting furnace.

In 2008, Oxygen bottom-blowing copper smelting furnace was successfully put into industrialization by Dongying Fangyuan Nonferrous Metal Co., Ltd. Annual capacity reached 80,000 tons of copper. The advancement of this technology has been accomplished in Fangyuan through years of development.

On Oct. 2012, a patent of “Second generation Oxygen-rich bottom-blowing copper smelting furnace and process” was granted to China ENFI, SKS Nonferrous Group and Dongying Fangyuan Nonferrous Co., Ltd.
1. SKS process, self-developed technology in China

Technology description

Technical Principle:
The raw material is loaded from the top, and oxygen-rich air is blown to the bottom to generate molten bath agitation. The whole process includes heating, melting, oxidation, Matte-generation and slagging.

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SKS Bottom-blowing smelting furnace

The furnace is horizontal and inclosed with transmission system, long cylinder shape, steel shell and Cr-Mg lining brick.
2. Features and advantages of SKS process

- **Energy Saving**
- **Higher Recovery**
- **Simple to operate**
- **Environment-Friendly**
- Less capital to invest and low cost to operate
- Broader adaptability of raw materials, capable of processing low content and high impurity copper concentrate

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Dalong Smelter in Vietnam

Commission on Jan. 2008;
Annual designed capacity of 10,000 tons of copper;
Bottom-blowing furnace Φ3.1x11.5m;
Phase II design is on processing, with an expanded capacity of 30,000 per year.

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Commission on Dec. 2008;
Annual designed capacity of 50,000-70,000 tons of copper;
Bottom-blowing furnace Φ4.4x16.5m;
Capacity increased to 100,000 tons of copper after renovation.

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3. Application and renovation of SKS technology

Henbang Smelter

Commission on Apr. 2010;
Annual designed capacity of 50,000 tons of copper;
Bottom-blowing furnace Φ4.4x16.5m;
Capable of processing low content 13-14% copper concentrate, Gold is one of main products.

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3. Application and renovation of SKS technology

Henan Yuguang Smelter

Commission on Sep. 2011;
Designed capacity of 30,000 tons of copper;
Bottom-blowing furnace Φ3.8x13.5m;
Capacity expanded to 60,000-70,000 tons of copper

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SKS tech practice and progress in Fangyuan

Bottom-blowing smelter copper production in Dongying Fangyuan proves:

- Low off-gas volume 1%-2%
- High copper recovery 98.67%
- Low oxygen consumption 620Nm/t matte
- Low energy consumption 140-160kg coal equivalent/t matte
- Listed on major renovation technology by State Council
- “SKS Tech” has been accepted as the first choice of smelting renovation by many new or expanded smelters producing copper and Gold in China.
- New smelters of Zhongyuan Gold, Dongying Phase II, Henan Yuguang, Shanxi Yuanqu, Qinghai Copper, Lingbao Mining, etc. have chosen “SKS Tech”, with a total capacity of one million tons.

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Global Balance of Copper Concentrate

Gap is shrinking and 2015 is the turning point

Resource: Gonzalenz

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Ore grade at all copper mines is decreasing

Annual ore grades at all copper mines by region


Data: CRU, Quarterly company Reports

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Change of Copper Mine grade

Concentrate grades have declined at key mines

Percentage change in copper concentrate grade, 2007-2012 H1

Data: Company reports

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Supply/Demand of Domestic Concentrates and Material Characteristics

- **Reserve**
  By the end of 2011, there were 1,793 proved mines, 28mt of proven basic reserves (10,950 kt of reserves) and 58mt of copper resource in China, according to Ministry of Land and Resources.

- **Characteristics**
  China has a large number of copper mines, but with poor quality, many are small ones with low grade, which are very hard to explore and development economically. The ore grade over 1% only contributes 24.7% of basic reserves (6.9mkt), while 50% of the basic reserves are around 0.5%, others are even lower.

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4. Potential benefit from global concentrate market

SKS Technology Development and Prospect

- Copper concentrate market will be oversupply in the next few years.
- Global copper concentrate grade will continue to decrease.
- Concentrates will be available at a lower price, especially those with lower grade or high impurities.
- SKS tech could bring more profit under the above circumstances.
Future of SKS Technology

★ SKS tech is adapted to the trend of decreasing copper ore grade, with its broader adaptability of raw material, which will bring economic and social benefit.

★ Oxygen bottom-blowing continuous converting technology is under developing. This technology is aim to replace P_S converter to solve problem of SO2 leakage and pollution.

★ In the field of processing anode slime

★ In the field of processing scrap containing precious metals
In 2006, Minmetals established a JV with Codelco, acquiring 840,000 tons cathodes for 15 years.

In 2008, Minmetals and Jiangxi Copper took over Galeno project in Peru with 8m tons of copper in reserve.

In 2009, acquisition of OZ and Restructuring MMG: Annual production of 80,000 mt SX-EW CATS & 150,000 ~ 200,000 mt Concs

In 2012, Minmetals stepped into Africa to explore more copper resources by acquiring Anvil.

Minmetals will continue to search high quality copper assets through subsidiary MMG.
5. Minmetals copper industry layout and planning

Partly Involved in Smelting and Fabrication Business

◆ Hunan SKS Copper smelting project: a smelter to produce 100,000 tons of copper cathodes & other precious metals by using Chinese self developed technology bottom blowing (SKS)

◆ Changzhou Jinyuan copper is a JV between Minmetals and JX with annual copper rod production capacity of 480,000 tons, the company focuses on high-end users and generates a stable return for years.

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5. Minmetals copper industry layout and planning

Marketing copper products globally to create more value

Minmetals is very experienced and professional on copper business marketing and management, providing excellent quality cathodes, concentrates, blisters and scarps through various of resources, cooperating with many world class mining, smelting and fabricating customers. Base on the company’s growing upstream and downstream resources, Minmetals copper team will continue to expand and improve our business, to create a global marketing, logistic and risk-control centre for all copper products, and to provide professional and integrated service for all of our customers.
5. Minmetals copper industry layout and planning

Brief intro of Minmetals Copper (Hunan) Co

Minmetals Copper (Hunan) Company is a platform to construct and operate SKS project phase I, the smelter will use Chinese self developed tech bottom blowing (SKS) to treat concentrate & other copper material to produce 100,000 tons of copper cathodes & other by-products such as gold, silver and acid.
Thank you!