

METALLURGICAL TESTING FOR IRON ORE

EXPERTISE IN METALLURGICAL TESTING, FLOWSHEET DEVELOPMENT & PILOT PLANTS

For the iron ore exploration and mining industries, SGS Minerals Services provides a comprehensive range of metallurgical testwork services. Our extensive global network of laboratory and metallurgical testing facilities support most of the processes that are used in the exploration and treatment of iron ore. At the broadest level, these include:

- Metallurgical testing at the bench or pilot scale:
- Comminution
- Physical mineral separation/beneficiation
- Hydrometallurgy
- Flowsheet development and pilot plant testing

METALLURGICAL TESTING

COMMINUTION

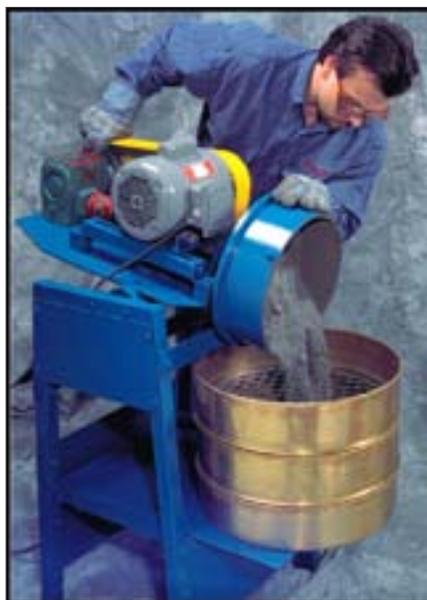
SGS Minerals Services supports the minerals and chemical industries in the design and operation of efficient crushing and grinding circuits using both power and model-based methods. We design circuits and provide operating advice to maximize milling efficiency, considering both steel and power consumption.

SGS Minerals Services' engineers have experience in operating SAG mill plants and have operated over 500 pilot-plant SAG circuits. This hands-on experience fosters a practical view of the design and operation of grinding circuits. Our practical experience also ensures that we recommend circuit configurations that offer ease of operation and maximum flexibility.

We have experience in many techniques, including the model-based approach and the empirical power-based approach, using the Bond and autogenous grindability tests. All data is analyzed and related to previous testing results. We compliment the JKTech models with mass-balancing, using the Bilmatt program. We suggest that the most robust results are obtained when more than one approach to grinding circuit testing and design is used.

SGS Minerals Services can complete the following grindability tests:

- SPI (Sag Power Index) Test
- Bond Ball Mill Grindability Test
- Bond Impact Test
- Abrasion Test
- JK Drop-Weight Test
- MacPherson Autogenous Grindability Test
- MacPherson 18" Mill Test



Well-instrumented pilot-scale autogenous grinding circuits, ball and rod mill circuits, and crushing circuits are also available for testing and design purposes. In-plant audits allow modeling and simulation of existing plants to assist in optimization. Rotary scrubbers and attrition scrubbers are available to test lateritic iron ores.

PHYSICAL MINERAL SEPARATION / BENEFICIATION

Separation of certain minerals can be efficiently achieved by taking advantage of their physical, electrical and magnetic properties. For example, iron ore, mineral sands, coal, and diamonds are some minerals that use at least one of these extraction processes. The product can then be further upgraded by chemical (hydrometallurgy) techniques.



All physical separation techniques can be tested at SGS, both on laboratory scale and pilot plant scale. The commonly used beneficiation techniques follow:

- **Gravity Separation**
Spirals are the most practical equipment to use for gravity separation of iron ores because of the high throughputs needed. SGS has a variety of spiral test rigs, including the spiral designs typically used in iron ore plants. Our accessory equipment allows sizing of feeds, multiple spiral stages, and recycling of products. Other gravity separation equipment, such as shaking tables, Falcon and Knelson centrifugal separators, Mozley MGS units, and hydrosizers, are also available.
- **Magnetic and Electrostatic Separation**
A full range of magnetic separators is available for iron ore testing, from low intensity drum separators to high gradient/high intensity separators, and for either wet or dry feeds.
- **Flotation**
Reverse flotation is commonly used to remove silica and/or phosphate from hematite-magnetite ores. SGS Minerals Services has strengths in both conventional cell and column flotation methods.
- **Selective Flocculation**
Although not commonly used, selective flocculation has been successfully piloted at SGS Minerals Services to remove silicate minerals from iron ores.

HYDROMETALLURGY

Hydrometallurgy is concerned with the principles and practice of the aqueous extraction of metals from natural or recycled resources and their subsequent recovery into useable products by means of environmentally sound and cost effective processes. Conducting metallurgical leach testing can provide an indication of reagent costs, equipment requirements, indication of metallurgical amenability to leaching and also provide environmental considerations due to deleterious elements or even acid rock drainage. While hydrometallurgy is not regularly used in iron ore processing,



SGS' expertise can be used perform this work on a laboratory and pilot scale if needed for specific projects.

FLWSHEET DEVELOPMENT AND PILOT PLANT TESTING

FLWSHEET DEVELOPMENT

SGS Minerals Services' experienced team of metallurgical professionals develop and demonstrate bankable flowsheets and processes for environmentally sustainable metal and mineral extraction processing. These flowsheets are confirmed on-site through bench and pilot plant testing programs that are internationally recognized by the mining, engineering and financial communities

Developing the most effective processing flowsheet reduces the technical risk. Alternative options can be assessed and a conceptual flowsheet developed which is then tested and optimized. Changes in ore-type, technology or environmental regulations can mean that existing plants must adapt their flowsheet strategies.

PILOT PLANT TESTING

Pilot testing is the best way to reduce risk associated with a new flowsheet or flowsheet changes. It will generate the data needed to design the full scale plant. As well, existing operations can be simulated at the pilot scale to evaluate new technologies or address problems without interrupting production. In a pilot plant, the actual process is constructed from appropriately sized equipment and the testing involves virtually all of the issues that a full processing plant will have to deal with.



SGS employs engineers having a combination of operating plant experience and laboratory/piloting experience. This is a rare combination in the industry and provides a much broader experience base than those that have exclusive exposure to either operating plants or laboratory/piloting testing.

Typical activities that can be undertaken during pilot testing include:

- Establish flowsheet viability
- Fine-tune flowsheet parameters
- Demonstrate continuous integrated operation
- Evaluate the impact of local water supply
- Develop a water balance
- Quantify the impact of ore variability
- Produce byproducts for specialized testing (e.g. environmental assessments)
- Generate bulk samples for market evaluation
- Train critical mill staff

EXPERIENCE

SGS Minerals Services has run over 20 semiautogenous grinding (SAG) and metallurgical pilot plants on iron ores, including extremely large plants treating up to 1,000 tonnes of ore and lasting for 6 months. Many complex circuits using autogenous grinding, de-sliming, magnetic separation, gravity separation, selective flocculation, and flotation have been run in our laboratories. Smaller pilot plant operations have been set-up on-site in major operating plants to test specific operations such as flotation, gravity separation, and thickening.



CONTACT INFORMATION

Email us at minerals@sgs.com
www.sgs.com/mining