Iron Ore Process Development

Metallurgical Testing Capabilities
Established in 1979 as Australia’s first, exclusive iron ore testing laboratory, today our dedicated team of iron ore metallurgy experts are globally recognised across a range of iron ore types including hematite, magnetite, goethite, limonite and itabirite.
Laboratory scale determination of metallurgical characteristics of iron ores plays a major role in the evaluation of new ore bodies, process flowsheet development, plant design, process optimisation and quality control.

The metallurgy of iron ore is becoming increasingly complicated. In the evaluation of a new iron ore deposit, it is essential that the chemical composition, physical properties, mineralogy and metallurgical characteristics be thoroughly investigated. The results of these investigations provide information for a new plant design to process the ore, evaluate the performance of this ore during processing through an existing plant and predict its performance in the sintering and smelting processes.

ALS Metallurgy’s iron ore process development testwork, at both laboratory and continuous pilot plant scales, minimises the technical risks associated with the development of iron ore projects through well-planned, well-managed, and well-executed metallurgical testwork programmes.

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Trusted by the international mining, engineering and financial sectors, our specialist iron ore metallurgists work with you and your consultants to develop and demonstrate successful processing strategies to support process optimisation, pre-feasibility and feasibility studies.

With industry leading expertise in geochemistry, mineralogy and metallurgy, the ALS Group can provide you with a wide range of services including:

**Exploration Services**
- Geochemical exploration services
- Geometallurgy
- Advanced mineralogy
- Scoping stage metallurgical testing

**Process Optimisation, Pre-Feasibility & Feasibility Services**
- Geometallurgy
- Ore variability studies
- Advanced mineralogy
- Metallurgical flowsheet development & optimisation
- Continuous pilot plant testing
Chemical Analysis
Accurate assaying is critical to the success of any iron ore testwork programme. With a state of the art analytical laboratory on-site at our metallurgical facility, X-ray fluorescence spectrometry (XRF) by fused bead is the method of choice for the analysis of iron ore samples generated from metallurgical testwork at ALS Metallurgy and in Australia.

There are a number of reasons for this preference:

- The elemental XRF spectrum is relatively simple. This results in very few spectral interferences.
- XRF spectrometers are the most stable analytical instruments commonly available in laboratories.
- Samples are presented to the instrument as fused disks. This eliminates solubility issues that may affect acid dissolution techniques.
- The flux to sample ratio is relatively low, thus providing good sensitivity for the majority of elements.

A typical iron ore analysis should include a loss-on-ignition (LOI) determination at 1000°C, normally undertaken by Thermogravimetric Analyser (TGA). The LOI is due to the loss of water from hydrated minerals (goethite, gibbsite and kaolinite), decomposition of carbonates (calcite, siderite and dolomite) and the volatilisation of organic compounds. The LOI may be offset to some extent by the weight gain due to oxidation of reduced iron and manganese mineral phases.

Determining the LOI at a number of temperatures (typically 371, 650 and 1000°C) will provide a guide to the actual minerals present in the samples. The lower temperature approximates the loss of water of hydration (dehydroxylation), while clays tend to decompose at approximately 650°C. This information is particularly valuable when analysing Channel Iron Deposits and Marra Mamba type ores.
Mineralogy

Production of a high grade iron ore product requires a thorough knowledge of the mineralogical parameters that might impact on the beneficiation of the ore.

This is particularly important for low grade iron ores that may require upgrading by comminution, gravity, flotation and/or other beneficiation processes since their mineralogical parameters (for example, particle density and shape) will significantly influence the efficiency of the upgrading processes.

Process mineralogical studies form an integral part of the economic and technical evaluation of iron ore deposits and, when done on a routine basis throughout the life cycle of the mine, will continue to assist with the identification of process improvement opportunities.

An accurate understanding of the mineralogical characteristics of your iron ore is also important to your geological, geometallurgical, metallurgical and marketing teams.

Our highly experienced team of mineralogists and technicians work closely with our metallurgists and pride themselves on providing the highest quality results and fast-turnaround times.

ALS Metallurgy’s integrated mineralogical approach using QEMSCAN®, X-ray diffraction, HyLogger™ and optical microscopy provides clients with an accurate, quantitative understanding of the mineralogical variability within a deposit.

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HyLogging™

ALS Metallurgy was the first commercial laboratory to install HyLogging™ spectral analysis technology for rapid, robotic scanning of iron ore drill core, chips and powder. This technology is used on a range of applications from logging and archiving core, mineral exploration, and mine planning, to geometallurgy and mineral processing.

The software generates digital images and surface profiles, and interprets spectrometer data to produce mineralogical information. In addition to identifying minerals, the HyLogger™ produces high resolution digital images to allow geologists to visually characterise the colour and texture of the materials being logged. Macro images of core sections and drill hole mosaics (composite images of core trays arranged in order of depth) are produced to allow geologists to identify changes in colour and structure over the full depth of the drill hole.

Derived data is readily exported into three-dimension (3D) visualisation and mine planning packages to allow geologists to combine multiple drill-hole results and accurately characterise and map mineral systems, and mineral characteristics relevant to geometallurgical and geotechnical requirements.

The HyLogger™ can log on average 250m of core per day scanning for iron oxide/hydroxide group minerals; aluminium/silica/magnesium hydroxide group minerals; sulphates; carbonates and more. Chip samples can be measured in their original trays and are scanned in groups of three, allowing approximately 2000-3000 samples to be logged per day.

Comminution

ALS Metallurgy offers a comprehensive range of crushing and grinding testwork:

- Autogenous media competency
- Bond abrasion index
- Bond ball mill work index
- Bond impact crushing work index
- Bond rod mill work index
- Comparative work index
- High pressure grinding rolls (HPGR) up to 10tph
- Inferred work index
- JK drop-weight test
- Levin open circuit grindability
- Pilot SABC (AG/SAG) up to 4tph
- Point load test
- SAGDesign (Starkey)
- SAG mill comminution (SMC) test
- Ultra fine grinding
- Unconfined compressive strength

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Hematite

ALS Metallurgy provides comprehensive testing for hematite ores.

On site, our 15 metre automated drop tower is used to estimate lump/fines ratios and the particle size distribution expected from the blasting and processing of your ore.

Lump and fines products can then be submitted for further beneficiation testwork or characterisation using standards accepted by the International Standards Organisation, Japanese Industrial Standards and Japanese Steel Mills:

Tests conducted:
• Tumble Strength (ISO/JIS)
• Reduction Disintegration Index (ISO/JSM)
• Reducibility (ISO/JIS)
• Decrepitation Index (ISO/JSM)

Bulk density, apparent relative density and true SG measurements can also be carried out.

Magnetite

The increased exploitation of low grade iron ore deposits containing magnetite has lead to an increased demand for complex beneficiation circuits.

All magnetite ore bodies will require some magnetic separation investigation.

Tests we regularly perform include:
• Davis Tube Recovery tests on stage pulverised samples
• Davis Tube optimisation tests versus grind size
• Dry or wet LIMS tests

ALS Metallurgy can provide large scale, continuous integrated pilot facilities for confirmation of batch test data.

Our expert magnetite team of metallurgists can work with you and your consultants to optimise existing magnetite beneficiation circuits or provide crucial data for feasibility studies, mine planning and marketing purposes.

General iron ore characterisation and beneficiation

Characterisation and beneficiation testwork for iron ores includes:
• Screening & cyclosizing
• Ericson cone heavy media separation
• Dense medium cyclone separation
• Heavy liquid separation up to 4.05SG
• Alljig® laboratory jigging unit
• Spiral test rig
• Wilfley table
• Miniflux® fluidised bed separator
• Laboratory scale & bulk LIMS & WHIMS tests
• Flotation – direct & reverse silica
• Thermal characterisation tests
• Magnetic separation – LIMS/WHIMS

Piloting Facilities

With an extensive, flexible piloting facility for iron ore projects, plus a dedicated piloting team, we can configure a range of continuous circuits incorporating:
• Bulk crushing & screening
• AG/SAG milling
• Ball milling
• HPGR
• Hydrocyclones
• Magnetic separation
• Dense medium cyclone plant
• Gravity separation
• Flotation
• Scrubbing
Metallurgical Solutions

ALS Metallurgy is part of the ALS Group, a diversified and global analytical laboratory and testing services company. ALS Metallurgy is the global leader in metallurgical testing and consulting services for mineral process flowsheet development and optimisation.

Extensive bench scale laboratory, large scale pilot plant facilities and expert metallurgists, provide mineral processing, hydrometallurgical, mineralogical and in-plant services to the global resources community.

Our metallurgical solutions are internationally recognised by the mining, engineering and financial sectors for all major commodities:

- Precious metals - gold, silver, platinum group metals
- Base metals - copper, cobalt, lead, zinc, molybdenum, manganese
- Iron ore - hematite, magnetite, goethite, itabirite
- Nickel - laterite & sulphide ores
- Uranium & thorium
- Rare earth minerals & other exotics
- Mineral sands
- Industrial minerals
- Tungsten & tin

ALS Metallurgy has an enviable reputation for delivering the highest quality extractive metallurgical testing service with accurate and timely data, expert support and a culture of safety and innovation.

Contact Us

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