

Flotation Testwork

From Bench Scale to Pilot Scale



Introduction

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.

Quality

ALS understands the value of data quality and integrity to exploration and mining companies. Our processes are designed to ensure clients receive the best quality assay data to assist informed decision making. The ALS quality program consists of a series of checks and balances with monitoring at senior management levels.

Health, Safety and Environment

Being an employee of ALS is about putting safety first. Globally, ALS is committed to a safe work culture.

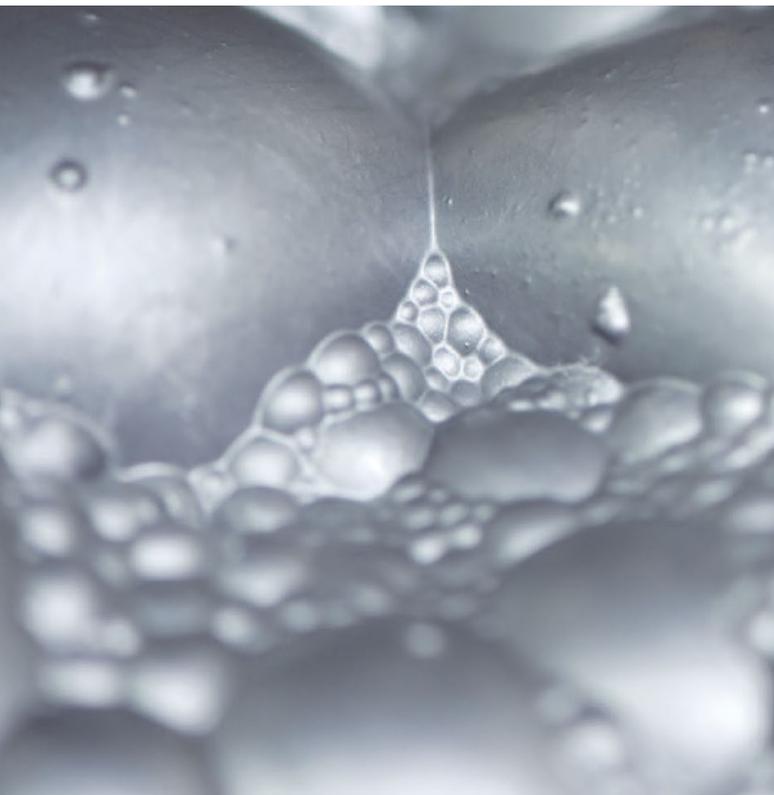
SAFETY MANAGEMENT

As part of this global approach, ALS has developed an industry leading standard for managing health, safety and environmental issues.

PROTECTION OF THE ENVIRONMENT

ALS has Extensive procedures and policies to ensure Protection of the Environment. Specific procedures and policies address the following issues:

- Waste Management, Monitoring and Maintenance;
- Disaster Management plans for spills;
- Management of Solid waste, with recycling where possible.



NICKEL

LATERITE & SULPHIDE ORES

BASE METALS

COPPER, COBALT, LEAD, ZINC, MOLYBDENUM, MANGANESE

PRECIOUS METALS

GOLD, SILVER, PLATINUM GROUP METALS

IRON ORE

HEMATITE, MAGNETITE, GOETHITE, ITABIRITE

Extensive Services

ALS Metallurgy's flotation extraction process development test work, at both laboratory and pilot plant scales, minimises your technical risks associated with the development of projects, through well-planned, well-managed, and well-executed metallurgical testwork programs.

Today froth flotation remains the separation process of choice for most sulphide deposits, and an increasing number of other minerals, around the world.

Our operations in Australia (ALS Metallurgy) and Canada (ALS G&T Metallurgical Services) are ISO9001 certified and have established a global reputation as a leader in flotation process development and optimization.

ALS Metallurgy is trusted by the international mining, engineering and financial sectors. Our flotation specialists work with you to develop and demonstrate successful extraction processing strategies to support process optimisation, prefeasibility and feasibility studies for a range of ores including:

- Base metals
- Precious metals including refractory gold ores
- Phosphates and oxides
- Iron ore

Flotation testwork is carried out from rougher, cleaner and locked cycle tests right up to continuous pilot plant circuits.

Chemical Analysis

Accurate assaying is critical to the success of any flotation test work programme. With a state-of-the-art analytical laboratory on-site at our metallurgical facilities ALS Metallurgy can perform an extensive range of analysis techniques. Results are continually monitored by a system of QA/QC standards and external round robin checks.

Mineralogy

A thorough understanding of the mineralogy of the ore is crucial to the success of any flotation test work programme. Our leading edge mineralogy services include, QEMSCAN, X-ray diffraction (XRD) and optical microscopy. When performed during exploration and feasibility stages of the project such information can identify and quantify key parameters that might influence the viability of a project. Information can be incorporated into geometallurgical models to assist with reserve and resource estimations and with mine production planning.

Sample Preparation, Screening and Analysis

Our extensive crushing, screening and splitting equipment ensures accurate representative samples are produced. Test samples from a few kilograms to many tonnes can be prepared and treated. Particle size distribution determination can be conducted via sieve screening and laser sizing methods. For finer particles, i.e. less than 38 µm, cyclo-sizing can be conducted, with the finer fractions being collected and assayed. Fine screening can also be conducted down to 10µm. Apparent relative density determinations and true SG determinations are also conducted.

Bench-scale Flotation

Our flotation metallurgists have experience in a comprehensive range of minerals including complex sulphides, precious metals and refractory gold ores, phosphates and oxides.

ALS Metallurgy can provide customised bench-scale flotation test work programs, in preparation for pilot-scale test work or as an isolated program. Tests may be performed in batch or as a locked-cycle program to predict concentrate recoveries in a plant situation.

Bench flotation test programs are commonly designed to consider the following parameters:

- Flotation kinetics
- Grind size
- Reagent selection and optimisation
- Selective flotation (complex sulphides)
- Pulp potential
- Flowsheet design

Our equipment includes a range of Agitair and Denver cells with full instrumentation. All flotation test work is performed by trained, experienced metallurgical technicians to ensure consistent, reliable results.

UFG Milling

ALS Metallurgy operates several ultra-fine grinding mills for use in-conjunction with bench-scale and pilot plant flotation test programs. Regrind mills available include an IsaMill, Metso Vertimill, Deswik mill and Metprotech mill. Whole ore or intermediate concentrates can be ground to as fine as 5-6 µm to liberate valuable minerals.

Pilot plant flotation

Continuous pilot scale flotation programs can be run in conjunction with comminution, regrind circuits and thickening/filtration to provide crucial information for plant scale operation.

Our flotation cells range in size from 1.5 to 300L and can be arranged to simulate various circuit configurations from 15 kg/hr to 2 tph.

A wide range of screening and sample crushing capabilities are available including AG/SAG, Ball and Rod milling and fine regrinding (UFG). Gravity, leaching and magnetic separations are also available and dewatering/process water recycle can be investigated.

Specialised flotation cells from conventional to column flotation technologies are available including flash flotation cells. Prioritised assay turnaround provides near real-time results allowing operating parameters to be optimised and alternative reagent schemes trialled during continuous operation.

Pilot scale flotation can also be performed in batch to provide bulk quantities of concentrate or tailings for further testwork.



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