GROUP

03

MINERAL PROCESSING & EXTRACTIVE METALLURGY

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MISSION

In a mining operation, several mineral types compose the extracted minerals. Some of them have commercial value, usually the less abundant ones, while others are of less or no relative value.

Extractive metallurgy is a set of processes that is carried out to separate selectively the types of mineral of interest from those considered as of no value. Generally, extractive metallurgy is sub-divided into four areas: mineral processing, hydro-metallurgic processes, electro-metallurgic processes and pyro-metallurgic processes. Each one of these areas faces increasingly complex challenges because of the sustained decline of grades in ore deposits, the appearance of penalized elements, and more demanding environmental regulations.

The group aims to generate and transfer knowledge to create procedures and develop technologies that lead to a better use of available resources as for both currently exploited deposits and identified reserves, there is a need to face the future challenges.

FIELDS OF EXPERTISE

- Characterization of mining-metallurgical materials.
- R&D for alternatives to current mineral treatment and complex materials for processes.
- Diagnosis, control and optimization of metallurgic processes.
- Chemical and bacterial leaching of minerals and concentrates.
- Characterization of air dispersion in flotation.
- R&D in continuous processes of copper pyro-metallurgy.
- Stabilization and neutralization of copper complex materials, which are rich in arsenic and antimony impurities.
- Electro-winning, electro-refining and electro-dialysis.
- Multi-variable modelling and simulation of metallurgic processes.
- Processes instrumentation development.

TEAM

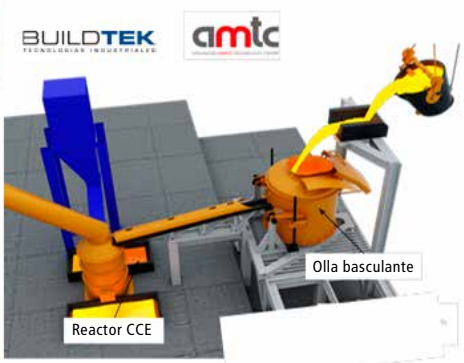
Principal researchers:
- Christian Ihle, PhD.
- Willy Kracht, PhD.

Associate researchers:
- Manuel Caraballo, PhD.
- Tomás Vargas, PhD.
- Leandro Voisin, PhD.
- Melanie Colet, PhD.

3 PhD. students

17 MSc. students

Conversion Reactor



Pilot Plant

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ADVANCED MINING TECHNOLOGY CENTER

PROJECTS

1. PHOSPHORUS RECOVERY FROM DISCARDED MATERIALS USING BIOLEACHING WITH AUTOTROPHIC MICROORGANISMS

Fundamentals

This project seeks the use of mesophilic and thermophilic sulfide-oxidant microorganisms as mediating agents in phosphorous recovery from discarded material. The waste is produced by Vale S.A. in their production facilities of phosphate fertilizers in Brazil. The process involves the dissolution of phosphorous contained in the discards using leaching with sulfuric acid, which is produced by bio-oxidation of low-cost residual sulfur.

Goals

The project aims to:

- Optimize the production of sulfuric acid by bio-oxidation of sulfur using mesophilic and thermophilic microorganisms.
- Optimize phosphorous solubility in discarded material using leaching with biologically generated sulfuric acid.

Results

The team developed and optimized a process with a circuit that includes a sulfur bio-oxidation and a phosphorous leaching reactor. The circuit allows retrieving phosphorous from discarded material in an efficient and economical way.

Team

Researchers: Tomás Vargas, Blanca Escobar, Lexian Xia, Simon Beard.
Laboratory technicians: Emma Fonseca, Loreto Bravo.
Thesis students: María Fernanda Godoy, Rachel Pacheco, Rhida Lira, Hans Allendes, Matías García, Mabel Araneda.

2. IN SITU COPPER MINERALS LEACHING

Fundamentals

Steady decline of copper minerals' law, increasing depth of ore deposits, and higher energy costs in extractive and comminution processes, make harder to retrieve copper in an economical way. This project proposes the development of advanced methodologies for copper recovery using in situ leaching technologies. For this, the projects consists of a multi-disciplinary team of researchers, formed by geologists, geochemicals, mine engineers, hydro-metallurgists and hydrologists.

Goals

The project aims to develop methodologies to improve in situ leaching technology based on the principals of mining, fluid dynamics, chemical and biological, to reach high levels of copper recovery with an adequate control of solution emissions to the environment.

Results

The project developed procedures to evaluate the applicability of in situ leaching of copper deposits based on the development of underground mining in brownfield operations. It permitted the development of chemical/biological procedures to improve the accessibility of leaching solutions to ore's metallic values.

Team

Researchers:
Tomás Vargas, PhD. Raúl Castro, PhD. Christian Ihle, PhD. Manuel Caraballo, PhD. Eleonora Widzyk-Capehart, PhD.

Thesis students: Carolina Bahamondez, Francisco Rojas, Carla Muñoz.

Cooperation with other organizations:
Cape Town University, CSIRO, CChen.

Mineralization model in a plant

Figure 3 - Lateral [A] and front view [B] of the laboratory model. Sample compression by hydraulic press [C]