



CHALLENGE TITLE

Efficient Leaching of Primary Sulfide

CHALLENGE DESCRIPTION

Copper mining faces a growing dependence on primary sulfides, mainly chalcopyrite, which represents 70% of global reserves and is the most abundant sulfide mineral in Chile. However, its low reactivity under environmental conditions limits the efficiency of leaching processes, resulting in low metallurgical recoveries, long residence times, and intensive use of energy and reagents. The challenge seeks to close this technological gap through the maturation and validation of solutions at a technology readiness level (TRL) equal to or greater than 4, advancing toward semi-industrial and operational scale testing to demonstrate higher recovery, lower energy consumption, and more sustainable processes.

GENERAL OBJECTIVE

Contribute to the development of sustainable metallurgical processes through the maturation of technologies that enable efficient leaching of primary sulfides, increasing copper recovery and reducing energy and reagent consumption.

SPECIFIC OBJECTIVES

1. Co-develop technologies that enable efficient leaching of primary sulfides, increasing copper recovery and reducing energy and reagent consumption.
2. Develop and validate kinetic and simulation models to optimize operating conditions.



3. Design and execute testing protocols in semi-industrial and operational environments to evaluate technical, economic, and environmental performance.

EXPECTED RESULTS

- Technical reports with validation results at semi-industrial and/or operational scale.
- Validated simulation models to predict leaching kinetics in primary sulfides.
- Demonstrative pilots of leaching process performance in semi-industrial and operational environments.
- Comparative indicators of energy efficiency, reagent consumption, and metallurgical recovery.
- Technical guideline document for industrial adoption.

SCOPE

Includes:

- Piloting and validation of primary sulfide leaching technologies with TRL ≥ 4 in semi-industrial and operational environments.
- Evaluation of pretreatment technologies (physical, biological, chemical) that improve the reactivity of primary sulfides.
- Applied-level process modeling and simulation.
- Evaluation of technical, metallurgical, energy, and environmental performance.



Does not include:

- Laboratory-scale proof of concept or technologies with TRL < 4.
- Development of commercial-scale reagent production infrastructure.
- Solutions that imply additional risks for worker, equipment, or environmental safety.
- Technologies that increase consumption of strategic resources such as water or energy.
- Interventions that negatively interfere with continuity of the production process.

KEY PERFORMANCE INDICATORS (KPIs)

1. Increase in copper recovery (%).
2. Energy consumption (%) per ton of copper recovered.
3. Reagent consumption (%) per ton of copper recovered.
4. Residence time (days) required to reach target recoveries.

DESIRABLE CONTRIBUTION TO ITL CAPACITY BUILDING

- Training in advanced extractive metallurgy and unconventional leaching processes for operators.
- Development of validation and technological certification protocols applicable to leaching processes.
- Installation of capacities in modeling and kinetic simulation of metallurgical processes.

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