

# pH Control in Copper Flotation for Maximized Product Yield

## Background

Copper ore may be separated from crude ore using a flotation process that takes advantage of the physical (as opposed to chemical) properties of small copper ore particles. To maximize the copper yield, pH control is necessary in the flotation tanks.

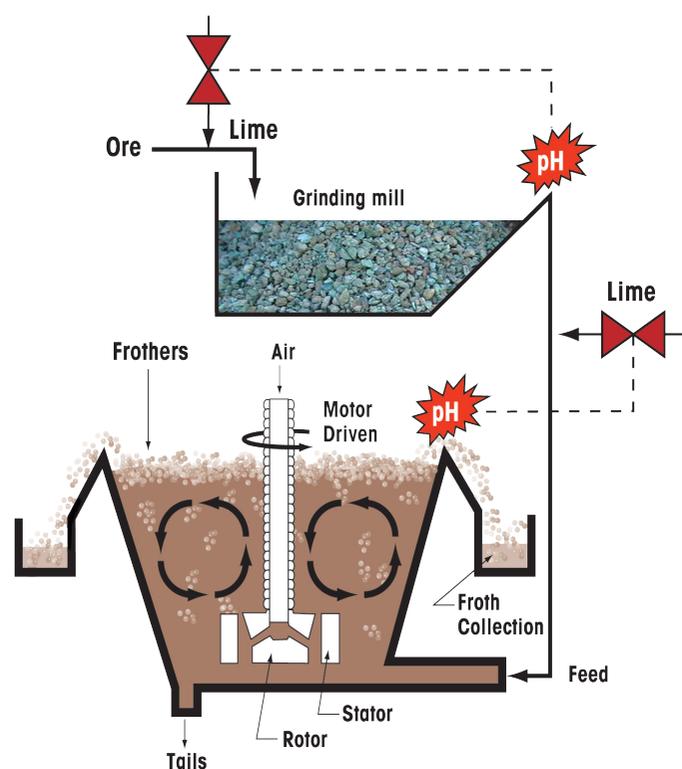
## The copper flotation process

Crushed ore, along with water and lime slurry, is fed into a ball mill. This rotating drum contains steel balls that crush the ore to a fine powder. When the ore/lime slurry emerges from the mill, it is fed to a rake classifier. Particles that are too large to pass from the classifier are returned to the mill, while the overflow is discharged to flotation cells.

Air is injected into the flotation cells, creating froth. Copper ore particles, due to their relatively light weight, become a part of this froth while heavier particles such as iron ore do not. The copper rich froth is then separated from the solution for further processing. (Figure at right)

Most copper ore slurries tend to be acidic. Plants typically add lime to the slurry in the mill or floatation circuit to increase its alkalinity. The condition of the froth is directly dependent on pH. The flow rate of lime slurry is therefore regulated to keep the pH within the acceptable range.

If pH is too low, iron will be entrapped along with copper, decreasing the value of the recovered copper.



If too much lime is added (pH too high), the result is a dilute froth that requires additional concentration in later stages, increasing lime usage and therefore operating costs.

A typical copper operation contains many flotation cells, often with a pH sensor in each cell. The number of sensors and their locations vary from plant to plant, depending largely on solution chemistry. The challenge is optimizing the location of the pH sensor in the slurry. The slurry velocity must be high enough to minimize lime scale and material buildup on the sensor but not so high as to result in significant abrasion to the sensor glass and body. Additionally, the pH sensor should be located at a point that is representative of the individual flotation cell's solution.

**Copper flotation instrumentation solutions**

The InPro 4260i or 4501 series solid polymer pH electrodes are especially recommended for control in the pH 12.5 range that is characteristic of flotation cell lime slurries. These electrodes feature the Xerolyt® solid polymer reference system which replaces the ceramic diaphragm of traditional electrodes with an annular junction, minimizing contamination problems so common in flotation applications. The large open junction is rugged and highly resistant to coating, resulting in reduced maintenance and process downtime.



The InDip 508 Immersion Housing is recommended for use with the InPro 4260i pH sensor. The optimal protective cage prevents the abrasive solids in the process medium from prematurely affecting the sensor's life. Its adjustable insertion length allows use in flotation cells of various geometries.

The M400 Loop-powered 2-wire transmitter with optional hazardous area certifications\* with HART communication and Intelligent Sensor Management (ISM) diagnostics is the right complement for the rugged environment of metal extraction. Sensor performance information is monitored in real time informing you when to clean, calibrate, and or replace the sensor.



M400 2-Wire Transmitter  
\*FM Class 1 Div 1 approvals pending

**Mettler-Toledo Ingold, Inc.**  
36 Middlesex Turnpike  
Bedford, MA 01730, USA  
Tel: +1 781 301 8800  
Fax: +1 781 271 0681  
Toll Free: +1 800 352 8763

[www.mt.com/pro](http://www.mt.com/pro)

For more information