

# pH/ORP measurement

## Copper flotation process



Mining – separating minerals by flotation

**Measurement made easy**

Mining  
separating minerals  
by flotation

### Introduction

The flotation process can separate a required mineral such as copper, nickel, molybdenum or zinc from ore. Flotation can separate this mineral from waste materials or from another mineral.

The process starts with crushed ore. A ball mill receives the crushed ore and reduces its particle size to the consistency of sand. Next, the ground ore from the mill travels as a high solid slurry to a cyclone that separates particle fines from heavier particles. The heavier particles are returned to the ball mill for further grinding. The cyclone overflow continues on to a series of floatation cells that separate the desired mineral from other materials.

Air injected into the floatation cells, along with foaming agents, creates a bubbly froth. An added chemical called a collector acts on the lighter mineral, causing it to attach to bubbles and rise to, or near, the surface. The float material then overflows or is skimmed off, while the bottom material goes on to another separation process or to waste.

The ability of a mineral to float depends on certain conditions. One important floatation variable is pH, that affects:

- the form of many ionic species present
- the charge state of the mineral surfaces
- the form of many collectors

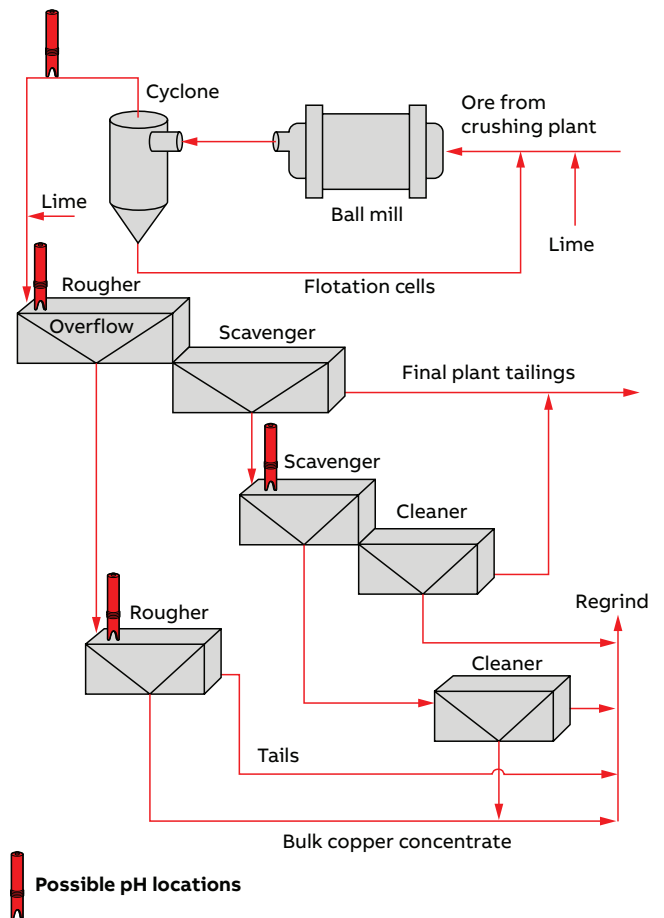
## Copper processing example

A high pH is important in copper ore processing to maximize this mineral's flotation properties. Most copper ore slurries tend to be acidic. Plants typically add lime to the slurry in the mill or floatation circuit, increasing its alkalinity.

A typical copper operation contains many flotation cells, often with a pH sensor in each cell. The number of sensors and their locations are largely dependent on solution chemistry and vary from plant to plant. Sensor life and maintenance quickly become important economic factors.

The pH sensor in any mineral processing slurry should be mounted to provide sufficient velocity past the sensor to minimize lime scale and material buildup. However, the location must trade off flow velocity with the possibility of abrasion to the sensor glass and body. Additionally, the pH sensor should be located at a point that is representative of cell solution.

Some plants monitor pH further upstream of flotation in the mill circuit. A typical mill circuit installation point would be in the cyclone overflow. Plants more generally mount the pH sensor in the floatation basin or the overflow line. Mounting in the overflow has the advantage of not totally submersing the back of the sensor, provided overflow depth remains constant. Care should be taken that the sensor is mounted deep enough to contact liquid rather than the top froth as this contains a high percentage of air. Most sensors have a submersible design with a rigid mounting.



## The ABB solution – TB556 for pH measurement

The fluid in a flotation circuit or flotation feed always contains a high percentage of solids. The pH sensor must be rugged to stand up to the inevitable abrasion by slurry particles and build-up of scaling resulting from lime additions. In the case of scaling or particle accumulation, hydraulic cleaners have been used successfully. The periodic jet of fluid prevents a build-up of pulp or scale.

Flotation plants commonly select the ABB TB556 sensor because of its resistance to abrasion of the pH electrode and plugging of the reference junction. The TB556 has an integral, patented Next Step Solid State reference. The sensor's large annular liquid reference junction provides added surface area that's less susceptible to plugging. The solid state reference design minimizes reference contamination, resulting in a more stable and accurate measurement. A flush flat-glass pH electrode surface reduces the adherence of particles abrasion and breakage.

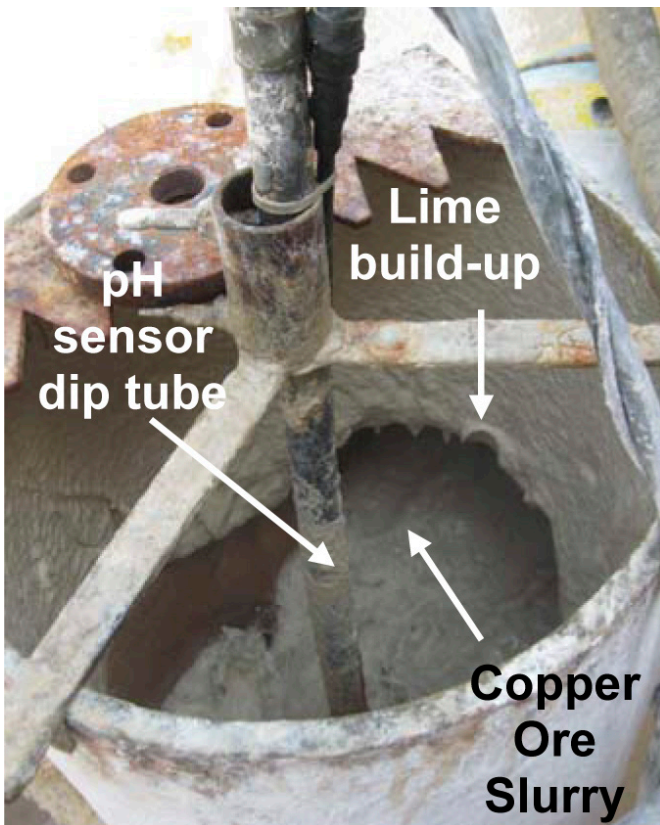


Figure 1 pH sensor in a floatation cell



Figure 2 ABB TB556 pH Sensor



Figure 3 ABB TB556 pH Sensor with hydraulic cleaner

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