

Clean energy

# Opportunities for improvement: optimizing metal recovery

## Cleaner copper mining in a carbon neutral world

**In this fifth in a series of notes, Ellen Thomson, PGNAA & Minerals Senior Applications Specialist at Thermo Fisher Scientific, examines strategies for improving process control across the concentrator to reduce environmental impact and improve profitability.**

In notes three and four of this series, I focused on ore sorting and the preconcentration of the process plant feed. Now, I'm going to move onto strategies for optimizing the processing of that feed, and the pivotal role of samplers and analyzers in providing a foundation for success.

### Follow the value

A first step towards optimizing metal recovery is to establish a robust metallurgical balance. This means quantifying how much recoverable copper is coming out of the mine and where it goes, that is, how much ends up in concentrate (product) relative to tailings (waste). These figures are key performance indicators for the concentrator, and are of interest to every stakeholder. Tracking dollar values of metal per hour through the concentrator highlights where value is being lost.

However, it's not just the value of the metal that needs scrutiny, as the cost of energy, chemicals, and water associated with recovering the product must also be considered.

For example, pushing the grinding circuit to produce finer particles liberates more metal, but lowers throughput and increases milling costs. There's a sweet spot where the ore is ground just enough, and optimizing grind size at this point minimizes grinding media usage and energy consumption within the constraint of economic metal recovery.

It's a similar story in the flotation circuit. Adding more reagents in the form of collectors, frothers, and pH modifiers can be

beneficial, but add too much, and you're increasing costs and incurring greater environmental impact for no gain. Success here relies both on the optimization of the incoming feed and effective tuning, through process control of flotation variables to process it.

Opportunities to optimize process control and economics extend right to the point of concentrate shipping. Detecting unacceptable impurities in the concentrate ahead of shipping can avoid the economic hit of rejection at the receiving site.

### Getting the right information

Robust information is the key to optimizing the concentrator plant's performance. Without accurate and timely data, concentrators are reliant on manual sampling, delayed assay information from the lab, the experience of the plant operators, and trial and error.

Sampling and measurement solutions work right across the mineral processing value chain. Too often the importance of sampling is overlooked, but it is a vital aspect of any plant measurement. High tonnages, concentrated slurries, long distances, and head limitations make sampling challenging. However, without a reliable, representative sample, measurement is not possible. Samplers combine accuracy and availability, and are highly competitive in terms of total cost of ownership.

Our measurement technology centers on elemental analysis and particle size measurement. Measuring head grade with our prompt gamma neutron activation analysis (PGNAA) cross-belt analyzers, and adding in real-time particle size measurement – for example, with the [Thermo Scientific™ Particle Size Analyzer PSM-500](#) – to monitor the grinding circuit, gives you the basis for advanced process control. Head grade, feed rate, and composition data, as well as grinding output particle size, enable the optimization of the grinding circuit and feed forward control of the flotation circuit.

Downstream of the grinding circuit, we're back to elemental analysis. Our slurry sampling systems are some of the most statistically robust on the market, and when coupled or integrated with XRF analyzers – such as the [Thermo Scientific™ AnStat-330 Online Sampling and Elemental Analysis Station](#) – our instruments deliver exemplary data.

Using our samplers and analyzers, you can maximize metal recovery and optimize concentrator performance, simultaneously improving process economics and minimizing environmental impact. We understand how to best leverage these capabilities, and ***we can help***. Talk to us about your most pressing concerns, and let us develop a bespoke solution to optimize your concentrator's performance.

 Learn more at [thermofisher.com/copper](https://thermofisher.com/copper)

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