AUTOMATED WETCHEM SYSTEMS FOR COPPER SAMPLES

COPPER CONTENT IN MINING SAMPLES

INTRODUCTION

Mining companies require fast and accurate analysis of copper samples in order to determine the best processing methods for mined copper ore. Nucomat has developed several fully automated systems to streamline the wet chemical processes for analyzing Total Copper, Acid Soluble Copper, and leaching. These systems begin with a finely ground powder sample and conclude with diluted samples in test tubes, prepared for subsequent analysis. The test tube racks can be loaded onto an autosampler connected to an ICP-OES or ICP-MS instrument, enabling laboratories to calculate ore grade and trace elements efficiently.

In addition to robust hardware automation, Nucomat provides software-level integration, including bi-directional communication with the customer's Laboratory Information Management System (LIMS). This ensures optimal data flow and sample tracking. The data produced by the automated system serves as direct input for analytical instruments. The modular architecture of Nucomat's solutions allows for flexible, tailor-made adjustments to meet specific customer requirements.

Figure 1: Render of a Wetchem system for Cu samples

AUTOMATED COPPER ANALYSIS

Nucomat's Wetchem systems are capable of processing up to 250 powder samples within 24 hours, preparing as many as 750 analysis-ready samples, depending on the chosen configuration. The integrated software can run multiple user defined analytical methods. Using barcoded sample identification, it automatically selects the appropriate procedures. This enables laboratories to execute multiple methods simultaneously, providing seamless operational flexibility.

The main automated steps include sample dosing, acid dispensing, digestion, shaking, and dilution to final volume. Additional functions, such as filtration, salt addition, or internal standard incorporation, are also available, depending on laboratory needs.

Figure 2: Picture of a Wetchem system back-end, with integrated ICP-OES.

User case: Chuquicamata Mine, Chile

A customer utilizing the Wetchem system for samples received from the Chuquicamata mine in Antofagasta, Chile, benefits from a comprehensive setup comprising the following devices:

- Main gantry robot with a gripper for moving powder samples and 250 ml Erlenmeyer flasks
- Four powder sampling units for dosing sample mass into Erlenmeyer flasks
- Two fume hoods, each featuring:
    - A dedicated gantry robot resistant to acid fumes for flask handling
    - Two dispensers for concentrated acids (HCl, HNO3, HF, and HCLO4)
    - One mixing position
    - Sixteen-position hot block for hot digestion
    - Sixteen cooling positions
- Four transfer stations for moving aliquots into autosampler vials
- Two washers for cleaning and reusing intermediate flasks

Upon sample introduction, the system processes them according to the barcodes scanned from the sample jars. These barcodes may reference specific analytical methods, or a LIMS may assign methods linked to each sample. Initially, samples are weighed on an analytical balance with a precision of 1 mg (or 0.1 mg). After powder sampling and weighing, precise volumes of acids are dispensed within the fume hood. Hot blocks facilitate sample digestion, and a dedicated gantry robot ensures safe handling under corrosive conditions.

Once dissolved, samples are brought to volume under gravimetric control and homogenized by swirling. Aliquots are transferred into test tubes, placed in racks compatible with autosamplers for ICP-OES or ICP-MS analysis. All relevant sample positions, preparation details, and associated data are made available to the customer’s LIMS for comprehensive analysis tracking.

System Layout Overview

The example system described includes a range of integrated devices and features, ensuring efficient and reliable automation for copper sample analysis. The layout supports seamless sample processing from introduction to final analysis.

Figure 3: example system layout, as described in this paper.

NUCOMAT’S DISTINCT ADVANTAGES

- Proven expertise with over 20 years of experience automating mining wetchem laboratories
- Method editor for customizing individual sample preparation steps and parameters
- Gravimetric control for both sample and system performance
- Sample cleanup with automatic sample repeat functionality
- Drawer-equipped system for uninterrupted sample replenishment
- Main storage area mounted on a wheeled trolley for easier and ergonomic maintenance
- Robust design and construction built to withstand corrosive conditions associated with hot acid digestion

Central web based software

The Wetchem platform is managed by **ROBIN**, Nucomat’s real-time event-driven **scheduling software**. Its intuitive web interface enables users to operate the system, monitor processes, and receive timely notifications for reagent replenishment, both on the system PC and remotely from the office desk. All samples are electronically **tracked** from registration to result, and relevant actions are logged to a database. Automated management includes instrument calibration, control, reference sample analysis, and cleaning cycles. Additional **process control rules** can be implemented as needed. Sample data can be validated online and released for **reporting** with flexible **input and output** formats supported.

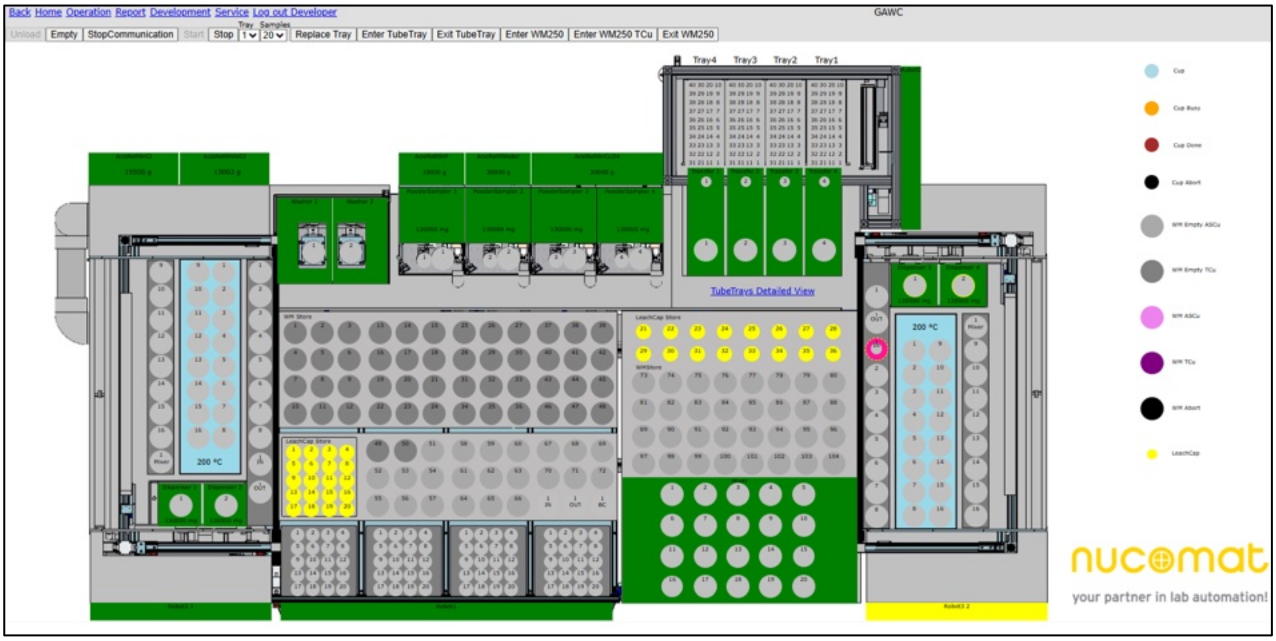

Figure 4: Web based ROBIN software user interface.

Customer Benefits

- **Operator safety** through physical isolation of hazardous chemicals, fumes, and waste
- Comprehensive sample **traceability** with data stored in a secure database
- Consistent **repeatability** and increased productivity through minimized human interaction
- Flexible and intelligent scheduling for maximum **efficiency**
- Bespoke, **turnkey** solutions tailored to customer requirements, including integration with third-party instruments

VIDEO

https://www.youtube.com/watch?v=d1h7zSmaNE4

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