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Copper Recovery increases by 4.6%

- Major producer uses Stone Three Froth Sensor in APC to increase copper recovery

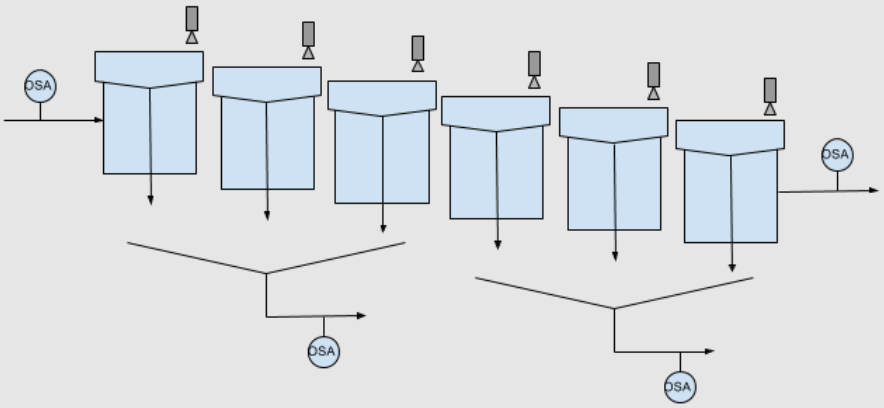
Extracts from Brooks and Munalala (2017

One of the largest copper operations in Africa mines and processes copper sulphide as well as oxide ore. The oxide circuit includes milling, flotation and a hydrometallurgical plant. Acid insoluble copper is concentrated by means of the flotation circuit, while the acid soluble copper is recovered by means of leaching. Owing to the complex nature of the ore and the inevitable variability thereof, optimal operation of the circuit is of paramount importance.

Challenge

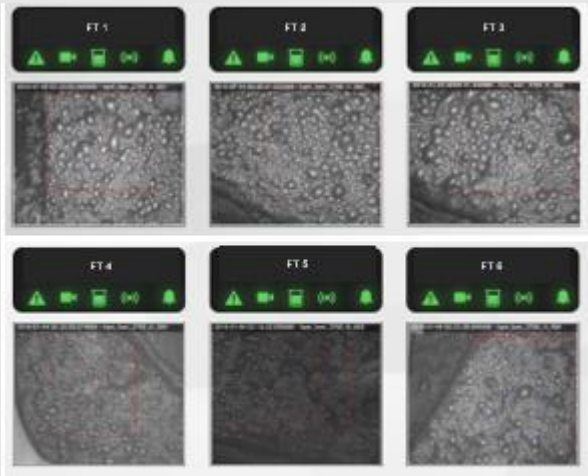
The economics of a flotation plant are largely governed by the operating point on the grade-recovery curve. Optimal operation requires maximum recovery of the valuable minerals, while remaining within grade specifications. A major problem however is the lack of available real-time measurements that can be integrated into control to ensure that optimal performance is maintained.

One of the key variables to consider is mass pull. Variations in feed grade, viscosity and feed rate create instabilities in the mass pull, where the latter is not directly measured on a per cell basis. This leads to recovery losses, which has a significant economic impact on the circuit profitability.



Solution

Understanding the critical role of real-time measurements for plant optimisation, a significant number of smart sensors were installed on the oxide roughing circuit. Grade information is present as a XRF scanner measures the Cu feed content, while metal content in the concentrate is measured by means of DRS. General operational information such as level and air measurements are obtained from existing plant instrumentation.



Key information on the froth characteristics was made available after the installation of Stone Three Froth Sensor image analysis technology on the six oxide roughers. The camera-based system is used to assist with the monitoring and control of individual cell performance. A robust froth velocity measurement is calculated by Stone Three Froth Sensor, which can be used as a proxy for mass pull.

In order to ensure continuous benefit, all of the aforementioned variables were integrated into a layered control infrastructure [(1)], which aims to stabilise mass pull and maximise mineral recovery.

Outcome

With the commissioning of the Stone Three Froth Sensor system, visibility on the froth phase's dynamic behaviour becomes available. This allowed for the targeting of a per cell mass pull contribution, leading to more stable operation of the rougher circuit.

Commissioning of the overall solution resulted in circuit improvements as an increase in mineral recovery was achieved. Assessment, by means of a before/after analysis, indicated that the **overall flotation circuit Cu recovery improved by 4.56%. The analysis further illustrated a 10.15% increase in recovery of insoluble Cu and a 2.58% increase in recleaner concentrate Cu.**

[(1)] Brooks, K. and Munalula, W. "Flotation Velocity and Grade Control Using Cascaded Model Predictive Controllers" *Control Conference Africa*, Johannesburg, South-Africa, 7-8 December, 2017

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