

Automating cyanide measurement & control using a modified potentiometric titration determination for highly variable complex copper gold ores

Greg Zwolak – Senior Scientist - Metallurgy; Orica

Gilmar Guzmán Salvador – Superintendent of Metallurgical Services & Processes; Newmont Yanacocha

Peter Leckie – Global Customer Solutions Lead (NaCN); Orica

Egonk Arriagada – Latin America Lead Process Plant Specialist; Orica

Online cyanide analysers are an established tool for the measurement & optimisation of cyanide-leach systems yet have well-known measurement & operational challenges in complex ores, namely:

- Inconsistent exclusion of interferences due to varying Cu & S feed mineralogy
- Subsequent overestimation of 'Free Cyanide' results by inclusion of slow-leaching $\text{Cu}(\text{CN})_3^{2-}$ complex
- Correct measurement more sensitive to correct configuration, often requiring specialised knowledge to troubleshoot
- Difficulties in confirming analyser results with operator performed titration techniques
- Reduction of signal to noise ratio due to interferences from other species
- Increased maintenance due to fouling & scaling caused by solution chemistry

Newmont's Yanacocha operation in Peru presented an especially challenging environment for reliable cyanide measurement and control, processing 3 semi-distinct complex ore types with feed Cu ranging from below 250ppm (as CuCN) to more than 5000ppm, and feed S ranging from low to 5%, resulting in cyanide consumption from as low as 1.5 kg/t to as high as 3.1 kg/t, and gold recovery ranging from approximately 57% to about 74 % (average plant performance based on the type of ore).

A literature search by the authors to identify a method for accurate cyanide determination that was also suitable for automation settled on the work of Breuer et al (2011) as a basis. Early challenges in adapting the laboratory technique for the 'real solutions' and the range of variability experienced in the plant are discussed, as are other operational challenges due to the complex and changing solution chemistry.

Despite the challenging environment, the new automated analysis technique was able to enable introduction of automated cyanide control on site, resulting in an instant change in cyanide control and consumption. Longer term process economic impacts on plant performance are also reviewed, with an accompanying discussion on opportunities to further enhance process control via integrating the extra information offered from this modified determination.