The Silver Cube Analyser - A High Accuracy On-line Elemental Analyser

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Modern mineral processing plants are equipped with analysis systems that monitor process stream chemistry at key points in the plant. These "online" instruments are used to monitor plant operating conditions in real-time and allow the operating parameters of the plant to be adjusted to suit the current processing conditions. However, the physical nature of process stream slurries and the harsh environment within processing plants mean that these analysers are typically only able to measure elemental concentrations of tens of parts-per-million (ppm) and above. Many commercially important metals are present at levels far below this in natural ore deposits.

More accurate analysis is limited to off-line analysis techniques, in which the streams are sampled, typically on a per-shift basis, and the material collected is taken to an on- or off-site laboratory for analysis. These offline analysis methods are usually error prone due to the small sub-sample measured and can take hours to days to be complete. Therefore, they cannot be used to detect plant upsets in real-time or be used for process control.

The CSIRO Mineral Resources X–ray Team have developed and XRF analyser that is suitable for both direct, on-stream elemental analysis and routine in-plant batch analysis of process stream slurries. The Silver Cube is a high-accuracy XRF analyser that can be configured in two ways: 1) as an online analyser directly measuring a process stream without sampling, and 2) and a batch slurry analyser for routine, in-plant analysis.

The two configurations share the same XRF analysis unit and control electronics. The difference is only in the way the sample is presented to the analyser. In the online configuration, the analyser head is mounted directly to a process stream pipeline. The stream flowing through the pipe is continuously and autonomously measured and the elemental data collected is fed to the plant control centre for monitoring and process control. In the batch analyser configuration, the analyser head is attached to a launder tank and forms a portable, standalone measurement system. This system allows large slurry samples to be collected (about 11 L) and measured in-plant without any further sample preparation. A full analysis can be conducted in as little as 10 to 20 minutes.

Two Silver Cube systems (one pipe and one batch system) have been developed and installed at a platinum-group-metal (PGM) plant. The analysers were tested and factory calibrated in our facility before being deployed to the processing plant. Calibration was performed on a suite of synthetic slurry samples containing Pd, Ru and Rh. The calibration process involved adding various amounts of each PGM to 9 slurry matrices. Precisions of 0.5 ppm, 1 ppm and 0.6 ppm were obtained for Pd, Rh, and Ru respectively for a 2 hour measurement time. The two analysers are currently being tested in the processing plant. The results of the field trial will be presented.