REAL-TIME MONITORING OF PROCESS STREAM MINERALOGY AND ELEMENTAL COMPOSITION WITH THE XRDF SYSTEM

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Minerals processing techniques are sensitive to the elemental and mineralogical composition of feedstocks. Changes in composition can markedly alter the operating conditions of processing plants, leading to lower extraction efficiencies and reduced revenues. For this reason, processing plants use a variety of methods to monitor the compositions of feed, tailings and concentrate streams. These can be broadly classified into two categories: on-line and off-line analysis. On-line measurements are performed directly on the process stream, or a suitably sampled stream, in near real-time. Such measurements allow the plant operators to adjust the operating conditions to suite changes in process stream composition. Off-line analysers measure samples in on- or off-site laboratories. Samples are typically collected on a per shift basis and hence cannot provide plant operators with real-time feedback on plant conditions.

We have developed an on-line analyser capable of simultaneously monitoring the elemental and mineral composition of a process stream in near real-time. The X-ray Diffraction and Fluorescence (XRDF) Analyser performs both ultra-trace elemental and bulk mineralogical analysis directly on a process steam slurry. Elemental analysis is performed by energy-dispersive X-ray fluorescence (XRF). A separate transmission energy-dispersive X-ray diffraction (EDXRD) analyser measures the bulk mineralogy of the slurry. EDXRD allows large sample volumes to be measured using high X-ray energies, making the measurement of unprepared process stream material possible.

The XRDF analyser consists of a launder tank, XRD and XRF components, an industrial chiller and control electronics. Slurry flows into and out of the tank at a continuous rate of 10-30 L/min. The system consists of a single X-ray tube, which is shared by the XRF and XRD systems along with the cooling and control electronics. The combination of the two systems into a single unit reduces complexity and cost compared to two standalone instruments. The XRD and XRF instruments analyse the slurry inside the tank, providing regular updates on both the elemental and mineralogical compositions.

An industrial prototype XRDF analyser has been developed and is currently being field-trialed in a minerals processing plant. The design of the prototype analyser was optimised to measure ore containing the platinum group elements (PGEs). Specifically, the XRF instrument measures the PGE content of the process stream with an accuracy, determined by laboratory tests, of less than 100 ppb (one standard deviation, dry basis). The XRD analyser measures the relative abundances of the pyroxene, feldspar and alteration silicate minerals contained in the ore. The elemental and mineralogical data is fed to the plant at 5 minute intervals and is available for monitoring and process control. Results obtained during the field trial will be presented.