On-Stream Mineral Analysis for Process Control and Optimisation

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ABSTRACT

The mineralogy of process stream slurries is a key factor in determining the efficiency of a mineral concentrator plant. CSIRO has developed a novel X-ray diffraction (XRD) analyser that directly measures the mineralogy of process stream slurries on-line and in real-time. The analyser utilises the energy-dispersive X-ray diffraction (EDXRD) method. EDXRD is well-suited to the on-stream measurement of slurries, with advantages over conventional laboratory XRD including:

1. No sample preparation is required. The slurry stream can be measured directly.
2. A large volume of material is measured using a new probe design. Tens or hundreds of kilograms of material is measured per measurement cycle.
3. Rapid measurement times are possible. Results can be available in less than 10 minutes.
4. Simple apparatus with no moving parts.

Different configurations are possible depending on the application. In one configuration, the analyser is mounted to a 60 L launder tank which accepts a sub-sampled flow of material from the main process stream. In this configuration, the system can be coupled with CSIRO's on-line elemental analysers such as the On-line Gold Analyser (OLGA) or Versatile Real-Time X-ray Analyser (VRT-X), providing a complete elemental/mineral analysis package. Alternatively the EDXRD system can be arranged as an immersion probe that is inserted into an existing launder.

The instrument is applicable to a wide range of processing applications. Examples include copper and gold ore (pyrite measurement), lithium minerals and platinum-group-metal processing, to name a few. Both economic mineral phases and gangue mineralogy can be measured with the system. The XRD analyser is optimised for measuring the mineral phases of interest in the stream, enabling the best possible performance to be obtained for the specific application.

Currently, CSIRO is undertaking proof-of-principle studies to demonstrate the XRD system. These studies are being conducted using an analyser mounted to a small launder tank with a slurry capacity of 13 litres, with samples measured in batches . This paper presents results of these studies conducted on suites of mineral slurry samples. Examples of potential implementations in a mineral processing plant for real-time mineral analysis are also discussed.