

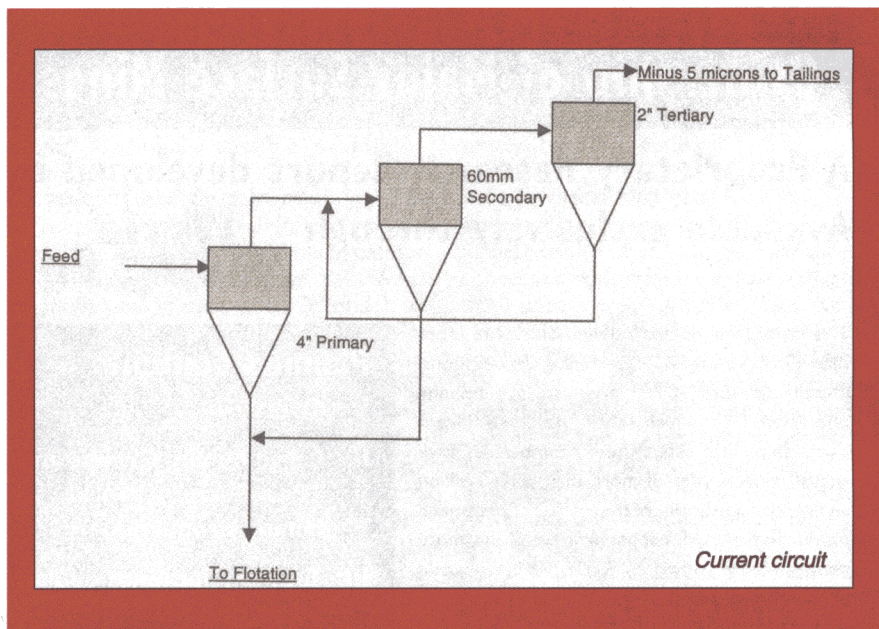
filtration

tems for solid-liquid separation equipment selection, in particular the free one downloadable from: www.filtration-and-separation.com. This includes selection by filter cake resistance values that can be estimated by the integrated modelling utilities or found in a look-up table expressing cake resistances as a function of cake forming pressure. Holdich also reported progress in the use of slotted surface microfilters for minerals clarification, as an alternative to membrane microfilters with circular pores – which are easily blocked in this type of application.

Opening the second day's proceedings, Ian Townsend of *Larox* (one of the conference sponsors) outlined applications of the latest automatic pressure filters. These range 60-144 m² in filtration area and can often eliminate the need for thermal drying - and also considered the design of the pressure filter "plant" as a whole, including ancillary equipment selection and layout. *Eimco* equipment featured in two presentations, one by Rob McConnell from the Cleveland Potash operation in England and one by S Slottee of Eimco USA, both co-authored by Liam MacNamara of Eimco UK. The first discussed the addition of an Eimco horizontal belt filter and E-cat thickener at the Boulby mine, which already had four conventional Eimco thickeners but where space limitations made small footprint equipment attractive. The second paper examined applications of Eimco high-density and Deep Cone™ thickening technology, which yields underflows classified as paste rather than slurry and can eliminate the need for subsequent filtration in certain circumstances. Used for thickened tailings discharge the Deep Cone paste thickener enables the material to be impounded with steeper angles of repose as well as for the longer established use as mine backfill. Other applications include highly efficient CCD circuits and the thickening of slurries for cement kiln feed.

Day Three started with a second presentation from the *Tarbiat Modares University*, this one reporting an investigation of methods for separating barytes from the anode slimes produced at the Sar-Cheshmeh copper refinery in Iran. This separation is essential if the precious metals content of the slimes is to be recovered effectively. Classification using hydrocyclones and stub cyclones proved the most successful of the methods tried, with stub cyclones removing +60% of the barium sulphate in the underflow but directing almost all the precious metals to the overflow.

D-I Gabriele Adam discussed the application of Stokes' Law and computer flow simulations in the design of the new *Hosokawa Alpine Hydroplex AHP*, which achieves continuous wet counterflow classification in a centrifugal field. Using a



rotating deflector wheel, this machine can be adjusted to achieve precise separations in the particle size range 2–100 micron. This makes the Hydroplex suitable for use in the production of low volume but very tightly specified minerals.

Drag force

Whereas particle size and elemental measurements in mineral processing plants are automated, determination of moisture in granular bulk materials still relies on the classical technique of loss in weight, utilising uncontrolled procedures, explained Phil Cancilla of Canadian sampling specialists *Heath & Sherwood*. Presenting a novel on-line method on behalf of co-authors Paule Barette and Frank Rosenblum, both with *Noranda*, Mr Cancilla added that delays in reliable feedback can result in moisture varying from 5–12% (rather than a value within the generally preferred range 7–9%) before corrective action can be taken. That costs.

Having reviewed many available technologies, the *Noranda Technology Center* decided to utilise on-line direct physical measurement based on the drag force principle. The drag force applied to a stationary object in a granular medium is dependent on the medium particle size, surface tension and cohesivity, size and shape of the object, and the depth to which it is inserted in the medium. *Noranda* found that when the drag force principle is applied in a granular medium on a moving belt the only parameter that must be controlled for a true determination of moisture content is the bulk thickness of material against the force transducer's rod and disc. The first trial application - measuring zinc concentrate on a continuously loaded belt - was completed at the Brunswick Mining & Smelting operation in Bathurst during

1999. The sensor tracking plot showed only slight differences from laboratory analyses of check samples taken every 15 minutes.

However, the next application was both more difficult and more critical. At *Noranda's Horne smelter* slag is milled to a copper concentrate that is filtered for storage. During the last two years a 6 Sigma Project identified ways to reduce the filter cake moisture from 10.5 to 8% but, to ensure these gains from automation are maintained, the control plan requires on-line determination of the filter cake moisture. The prototype sensor was moved to *Horne* but more complex signal processing and averaging had to be developed in order to achieve a valid moisture reading because the 250 t/day of slag concentrate produced has to be filtered discontinuously. Innovative software was developed through a series of experiments to handle "no material present" situations. The calculated average moisture value is based on a final linear calculation model and output to a local display and to the plant DCS. Some 97.2% of observations now lie within $\pm 0.115\%$ of the laboratory moisture value within the working range 7.22 – 9.29% moisture.

Mr Cancilla concluded by suggesting that the test work completed and the commercialisation of the on-line moisture sensor will lead to other applications in the area of reducing solid-liquid separation costs and ensuring moisture content consistency in material shipment. The technique is patented.

Horse to water

Spare a thought for the US innovator *Tetra Process Technologies*. As Phil Evans of Toronto-based license holder *HG Engineering* explained, the HDS™ high density sludge technology for precipitation