

## Journal Comment

Physical Beneficiation 2013 was the third conference of its kind, the first being the DMS and Gravity Concentration Conference held in 2006 and the second the Physical Beneficiation 2010 Conference. Physical beneficiation covers dense medium separation (DMS), gravity concentration, magnetic separation, electrostatic separation, and ore sorting –all processes that are widely used in the Southern African mining industry.

A total of 22 papers were presented during the two days of the conference, 19 and 20 November 2013, and covered a wide range of commodities and unit processes within the physical beneficiation field. Two keynote addresses set the stage for each day, with Lionel Falcon and Will Blair sharing their vast knowledge and experience in coal processing and DMS respectively. This issue of the Journal features 10 of the papers that were presented at this conference.

DMS is critical to the operation of coal and diamond beneficiation plants. It is also utilized in iron ore, manganese, chromite, and andalusite beneficiation as well as pre-concentration for platinum group metal (PGM)-bearing UG2 ore. DMS separates ore minerals from gangue on the basis of density difference, making use of a dense fluid that has a density between that of the ore minerals and the gangue. The feed to the DMS plant covers a wide size range, 125 mm to 0.5 mm, and initiatives are under way to extend this down to 200  $\mu\text{m}$ . Separating densities vary from 1.35 for metallurgical coal to 3.8 for iron ore (haematite), but current research is aimed at extending the upper limit beyond 4.

Gravity concentration is by far the oldest form of mineral beneficiation, going back literally thousands of years. As the name implies, this involves the separation of ore minerals from gangue on the basis of density difference. Gravity concentration plays an important role in the processing of diamonds, coal, gold, titanium minerals (ilmenite and rutile), zircon, chromite, iron ore, and manganese. The equipment used in gravity concentration has in the past focused on jigs, spirals, cones, and shaking tables. However, hindered settling classifiers have recently become more prominent, particularly for coal and iron ore.

Magnetic separation is key to the success of DMS by ensuring the efficient recovery and recycling of the dense medium, which consists of magnetite or ferrosilicon. It also features in iron ore recovery circuits and the beneficiation of vanadium-bearing magnetite. Magnetic separation is important in the concentration and separation of ilmenite, rutile, and zircon, and is used for removing iron impurities from industrial minerals. As the name implies, this process entails

separation of ore minerals from gangue on the basis of the difference in magnetic response. Low intensity magnetic separation (LIMS), which is used for the recovery of ferromagnetic minerals (such as magnetite), is well established and understood. Wet high intensity magnetic separation (WHIMS), which is used for the recovery of paramagnetic minerals (such as haematite) will assume greater importance in the near future, particularly for the beneficiation of fine (-1 mm) haematite.

Electrostatic separation is based on the separation of conducting minerals from non-conducting minerals. Although it has limited application, it is nevertheless an important unit operation in the concentration and separation of rutile (conducting) and zircon (non-conducting) in heavy mineral beneficiation circuits.

Ore sorting is still largely in the development phase. The presence of waste in ROM ore is unavoidable, and its removal before fine crushing and grinding can result in substantial benefits by increasing the grade of the feed to downstream operations while reducing the amount of material for processing. Ore sorting technology relies on distinguishing the differences in physical and or chemical properties between the ore and the waste, such as colour, density, magnetic response, or chemical composition. Its application promises significant results in the near future. A good example of the successful application of sorting is in diamond recovery, where diamonds are separated on the basis of their fluorescent properties when X rays are targeted on a stream of diamond and gangue particles.

A slight departure from the main theme was the inclusion of three papers on the contribution that screening can make to improving physical beneficiation performance. The first paper highlighted improved dense medium recovery, the second described the more efficient screening of ROM coal with a higher moisture content, and the third covered the use of fine screening of discard coal to recover a saleable product.

The conference was attended by 128 delegates represented mining companies, research institutes, academic institutions, and technology and equipment suppliers. Feedback was very positive, and there was strong interest in a repetition of the event in the future. The conference was generously supported by sponsorship from 14 companies, which further confirmed the significant interest shown in physical beneficiation by the mining industry.

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