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At Prominent Hill, a rougher concentrate is reduced from over 100µm to 24µm by a M10,000 IsaMill, and is then treated by a Jameson Cell

years, with the development and commercialisation of the Isa Process™ copper EW and ER technology in the late 1970s, as well as the Isasmelt™ top submerged lance

(TSL) smelting process in the early 1990s. Both technologies have had a significant influence, offering low cost copper production from highly efficient and productive operations. However it is in mineral processing that XT believes further gains are still to be made, in particular, in the grinding and flotation fields.

Traditionally mineral processing plants were designed to crush and grind the ore feeding the plant to the liberation size of the required valuable mineral. This approach naturally ground not only the valuable mineral to the required size, but also the gangue minerals – wasting a lot of unnecessary power and effort. A better approach however, is to determine how coarse can the feed stream be ground, and still get good recovery in the first separation stage, i.e. roughing in the case of flotation. The

focus in this case is on the gangue liberation. The next stage in processing is to determine how fine a grind is required to grind down the rougher product to make a high enough grade, where the focus is now on the mineral liberation. By using this approach the whole of the feed stream is not over ground, instead only a small section of the feed is ground

Xstrata Technology (XT) has been in the copper industry in some form for over 30

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down to the required size for valuable mineral recovery.

XT has been promoting these types of circuits to a variety of mineral processing applications. Copper circuits, in particular, need this type of grinding strategy, as the head grades of their resources decline, and even more material needs to be processed for every pound of copper produced. In particular, the experience XT has had using its IsaMills, at a range of sites and applications, offers even more energy efficiency to operators who use this type of milling technology in their regrinding circuits. The influence of IsaMill in regrinding is beneficial in two ways:

- High power efficiency. The grinding action in the mill produces attrition grinding from the grinding disc operating at high speed in a relatively small volume of fine media, increasing the chance of high intensity particle media collisions, resulting in very effective use of the available power
- Inert grinding environment. The media used in the mill is ceramic balls, so there are no ferric ions generated in the grinding process, creating relatively inert slurry conditions and contaminant free mineral surfaces, making them ideal for the down stream flotation or leaching processes.

Katie Barnes, Strategy Manager at Xstrata

Technology, said "The development of inert media over the years in grinding circuits has opened up a range of grinding applications for IsaMills™. In ultrafine grinding (UFG) circuits, it is not uncommon to use 1mm grinding media to achieve grinding sizes down to 7µm. However for coarser applications, as we have in some of the copper operations needing to grind down to 40 to 50 µm, larger media of 3 to 4mm is used. The media has certainly developed and improved over the years, along with the size of the IsaMill, so that now IsaMills can handle large scale regrinding circuits".

IsaMills are in a number of copper circuits worldwide, in a variety of applications. The Morenci operation in the US uses a M10,000 IsaMill to produce UFG for its copper pre-leach circuit, while IsaMills treat copper concentrate prior to cleaning at Neves Corvo in Portugal, and Prominent Hill in Australia, which use a M3000 (1.5 MW) and a M10,000 (3.0 MW) respectively.

One of the more recent installations, the copper/gold operation at Phu Kham, Laos, uses a M10,000 in its regrind circuit, followed by a Jameson Cell. In this circuit, coarse rougher concentrate is treated by the IsaMill, which then combines with the fine rougher concentrate, to be treated by a large Jameson

Cell. The Jameson Cell, a self aspirated flotation cell, then scalps out a final copper grade concentrate. The wash water system on the cell allows for the final grade to be achieved, and ensures the fast floated copper minerals to be quickly floated and collected to final concentrate, taking the pressure off the conventional flotation cells that treat the slower floating tails from the Jameson Cell.

This is good example of better circuit design leading to improved efficiency. Conventional cells are good at recovering minerals with slow flotation kinetics, and Jameson Cells are good at recovering fast floating minerals. Putting both technologies together maximises the chance of recovering both types of particles. A similar circuit is operated at Prominent Hill, where a rougher concentrate is reduced from over 100µm to 24µm by a M10,000 IsaMill, and is then treated by a Jameson Cell. A final grade copper concentrate is produced from the Jameson Cell, while the tailings are upgraded by three stages of conventional flotation. The wash water is very important on the Jameson Cell, as not only does it achieve the copper grade, but also eliminates some of the deleterious gangue elements that are present in the ore.

Steve Smith, Operations Manager at XT, said IsaMill technology is playing an important part

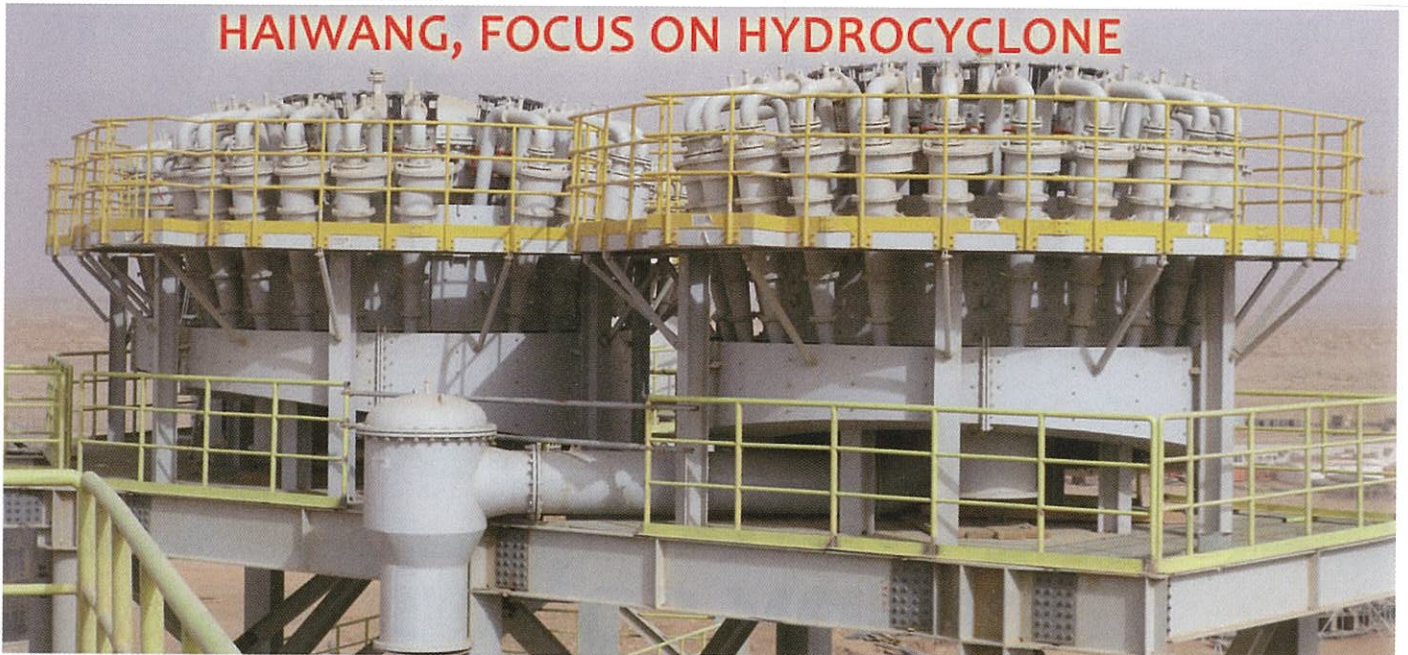


in the South American copper industry, with Xstrata Copper's Antapaccay and Las Bambas installing two and three M3000HF IsaMills respectively. The ever present need to efficiently grind was one of the key factors in the selection of this technology for these operations, as well as the small footprint, and the minimisation of over-grinding.

Another Xstrata Copper operation installing IsaMill technology is the Ernest Henry mine (EHM) in Queensland, Australia. While predominantly a copper operation, EHM has recently introduced a magnetite circuit to treat

the tailings of the copper concentrator, as the ore is predominately magnetite based. A M10,000 IsaMill is being installed in the circuit to further enhance magnetite recovery by reducing the size range down to 40µm. The operation is designed to produce 1.2 Mt/y of magnetite concentrate once it is up and running. EHM is only a handful of operations that includes a copper and iron circuit at the same site, and the use of IsaMill technology may offer an opportunity for other sites to establish similar operations that are based upon magnetite hosted orebodies.

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