

Therefore, it's priority to change the rotors' speeds to adjust equipment working characteristics.

As a fine crushing machine, dual-rotor vibration crusher has simple structure, large crushing ratio, and good overload protection performance. Study shows that dual-rotor vibration crusher is a promising crusher, and it should continue studying to optimize the shape and particle size range by changing the crushing cavity shape.

KEYWORDS

Crusher, self-synchronization, vibration coupling, metallurgical slag, crushing product size.

Paper — 265

TOWERMILL PERFORMANCES IN MAGNETITE CONCENTRATOR AND SCALE-UP VALIDATION

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ABSTRACT

Low-grade ore bodies, increase in rock competency, finely disseminated valuable minerals in the ore bodies, ore variability and water scarcity are among the technical challenges faced by the mining industry. These challenges have increased the business risk, capital investment and operating cost of the mining projects. Since the last 20 years, many large scale concentrators have been built to cope with the above-mentioned challenges. Comminution, especially the fine grinding is an energy intensive process. For example, the ball mill has a limitation in the fine grinding regime where the energy consumption increases exponentially when the product size is below 45 μm . The industry has been seeking for solutions that have a minimum risk and total cost of ownership. The stirred milling technology such as the TowerMill is well accepted by the industry as it has demonstrated the attributes required for fine grinding. Tower-Mill is a matured technology that has been adopted since the 80s for regrinding duty. Recently, this technology was installed in secondary and tertiary grinding duty to prepare a finer feed to rougher flotation. Four units of TowerMills were installed in a magnetite concentrator in Western Australia in tertiary grinding duty. Recently, Nippon Eirich has conducted process performance evaluation on the TowerMill circuit. The outcome of the exercise had indicated that the circuit is consuming 3.4 kWh/t to reduce from 55 μm to 35 μm with a narrow product size distribution. Furthermore, the tertiary TowerMill circuit exhibited other advantages such as regulate the feed to rougher flotation by absorbing the fluctuation in the secondary ball mill circuit, low grinding media (72 g/tonne of ore ground) and liner consumption (0.056 kg/tonne of ore ground). Conversely, the liberated gangue minerals and magnetite exhibited multi component density effect in hydrocyclone classification. The high-density magnetite has finer cut size compared to low-density gangue minerals, i.e. 29 and 55 μm respectively. This phenomenon has led to coarse material bypass in the hydro-

cyclone overflow stream. Besides the performance evaluation, the scale-up validation exercise was carried out by conducting a grinding test on the circuit feed sample. The specific energy requirement from the scale-up test shows close agreement with the industrial mill specific energy consumption. The scope of this paper includes the performances of TowerMill and the validation of scale-up methodology.

KEYWORDS

TowerMill, fine grinding, stirred mill, performance evaluation, scale-up

Paper — 288

IMPACTS ON ENERGY CONSUMPTION AND WEAR IN GRINDING CIRCUITS WITH A PRE-CONCENTRATION STAGE

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ABSTRACT

More complex ore comminution and concentration operations have found increasing application in the mining industry due to lower grades and higher complexity of the available ores. An alternative to coping with the higher capital and operating costs of ore processing plants is the use of pre-concentration stages. They allow removing a significant mass of material with little or no content of the relevant mineral before the ore is fed into the processing plant, with the consequent reduction in the mass to be processed in downstream operations. Significant benefits arise out of the use of pre-concentration, such as higher contained metal output without the need to increase the grinding or flotation capacity, and longer mine life. The grade of marginal ores could be enhanced to a level that would make their exploration economically feasible, which would result in increasing exploitable reserves. Nevertheless, few studies to date have assessed the resulting impacts on ore grinding energy consumption and wear after the gangue is removed through pre-concentration operations. This study evaluated the energy consumption and wear of grinding circuits in Brazilian mining operations in which the feed has gone through a pre-concentration stage. Such assessment was based on different samples of sulfide and oxide ores. Laboratory tests were carried out to investigate the power consumption and wear of grinding circuits with and without a pre-concentration stage. Laboratory test results were used to simulate industrial grinding circuits based on both alternatives and illustrate the environmental and economic benefits of each one.

KEYWORDS

Concentration, Pre-concentration, Comminution, Bond Work index, Wear, Operational costs.

Paper — 311

RESEARCH ON KINEMATICS OF MEDIA IN TOWER MILL BASED ON DISCRETE ELEMENT METHOD

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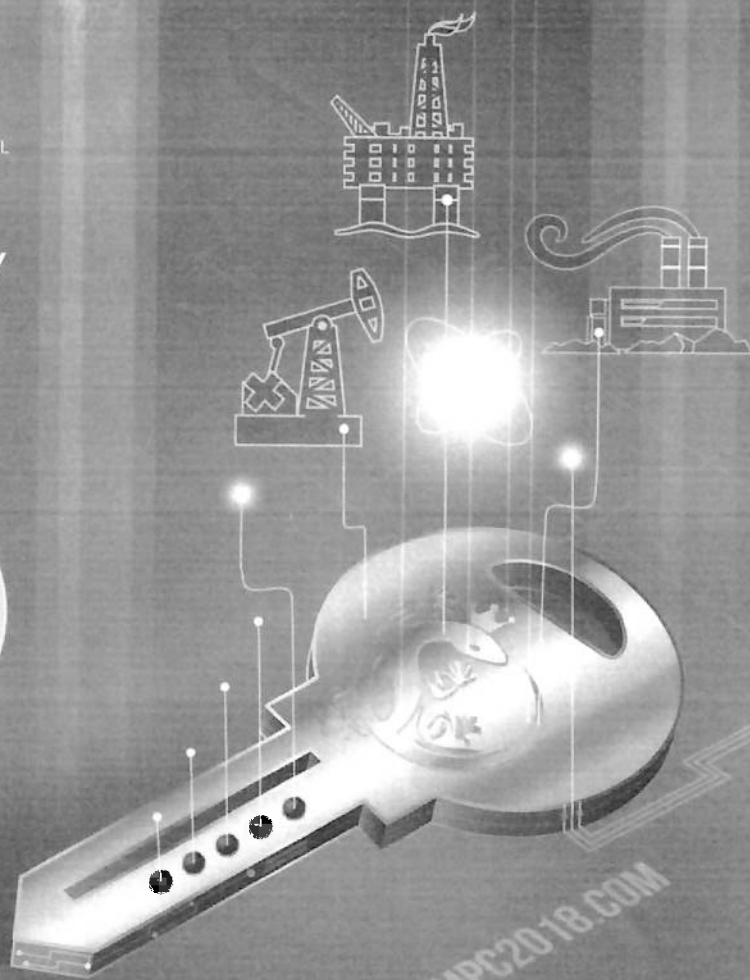
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