High density gravity separation circuits – A pathway to sustainable minerals beneficiation

M T Gill[1], *R M G MacHunter*[2], *E Raffaillac*[3]

[1] AAusIMM, Process Engineer, Mineral Technologies Pty Ltd, Dulwich SA 5065.
Email: matthew.gill@mineraltechnologies.com
[2] Senior Principal Process Engineer, Mineral Technologies Pty Ltd, Carrara QLD 4211.
Email: dolf.machunter@mineraltechnologies.com
[3] MAusIMM, Principal Process Engineer, Mineral Technologies Pty Ltd, Carrara QLD 4211.
Email: etienne.raffaillac@mineraltechnologies.com

Keywords: sustainability, spirals, tailings, water, high density

ABSTRACT

The global mining industry is facing significant challenges through declining ore grades and increased difficulty in securing required water and energy. When combined with increasing societal and shareholder pressure, it is evident that the industry must innovate to minimise the impacts of resource extraction and ensure a sustainable future.

Traditional mineral processing flowsheets, including gravity (spirals), magnetic and flotation, utilise significant quantities of energy and water for materials transport and to achieve optimum metallurgical performance. Consequently, these flowsheets are prime candidates to benefit from innovative approaches to lower water consumption.

Recent testwork, piloting and infield trials conducted by Mineral Technologies (MT) on their new compact turbo (CT1) separator has demonstrated high recovery of valuable minerals when operating at feed densities of up to 60 %w/w solids. This testing was conducted on various ores and showed comparable metallurgical performance at high feed densities compared to industry standard spiral separators fed at 35 %w/w solids.

A desktop study was conducted on a low-grade, high tonnage African mineral sand wet concentration plant comparing traditional and high density three stage spiral circuits (based on tested performance curves). The simulation showed reductions of >50% in total pumping volume and >60% in water usage, with proportional reductions in energy consumption and equipment sizes. The high density CT1 spiral feed also leads to a high density tailings product, which reduces tailings pumping volumes by >50%.

The high density spiral circuit presented in this paper represents a major step forward towards the industry utopia of waterless beneficiation. The demonstrated reductions in energy and water consumption and tailings volume will greatly reduce the environmental and social impacts of existing and new operations. The reduced capital and operating costs will improve the economics of lower grade marginal deposits and further increase the profitability of high grade prospects.