

Reduction in the Energy Cost of Minerals through at-the-face Comminution and Separation of Mineral and Waste.

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Abstract: High-pressure waterjets penetrate into material through the pressurization and growth of small cracks within the target surface. In mineral ores the individual grains of the constituent components are defined by the grain boundaries and these provide such surface cracks. Eroding the ore by a stream of high-pressure water can thus exploit the cracks so that they grow, inter-connect and remove the ore on a grain by grain basis. This separates out the individual components of the ore, as the ore is mined.

Because the properties of the different mineral grains differ, either in size, density or shape they can be separated, often quite easily, at the mining machine, as the grains are collected after being removed from the face. Thus, at the point of mining, the valuable components of the ore can be separated and collected. The remaining waste minerals can then be left adjacent to the mining face, potentially being re-cemented to provide support to the ongoing excavation. This joint mining and separation process saves the cost of transporting the waste rock out of the mine, and the costs of conventional separation of the valuable material at the surface. In current practice, all the ore mined is crushed, at the surface, to a very fine powder in order to achieve liberation of the valuable mineral. As well as requiring considerably more energy this also produces a very fine waste product, which is more expensive to dispose of, often behind large tailings dams at the surface, at an environmental cost.

The use of pressurized cavitation to enhance the process, and reduce energy needs and process time is a part of this work. This new process is anticipated to drop the energy cost of mineral production by up to 60% and has been validated in laboratory and some field tests.

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