

THE BENEFITS OF COARSE PARTICLE FLOTATION



Particles approximately 850 microns

ERIEZ
FLOTATION DIVISION

COARSE MINERAL PARTICLE FLOTATION

Developed in 1999 and later patented in 2002, Eriez was the first in fluidized-bed flotation. This coarse particle recovery system has the ability to capture particles up to and exceeding 2 mm. Having reshaped the industrial minerals market, the HydroFloat® is now being applied to the sulphide and base metal markets where test work shows there are numerous benefits not just in reducing capital and operating costs, but also for improving sustainability and environmental efforts.

Unlike conventional flotation, the HydroFloat only requires a small portion of the hydrophobic mineral to be exposed on the particle surface to be recovered. This surface area exposure can be less than 1%. In a typical concentrator, this can result in the creation of a coarse tailings stream that is beneficial for tailings management.

For sulphides and base metals, instead of grinding 100% of the ore to a size suitable for conventional flotation, the HydroFloat can treat particles at a relatively coarse size up to and exceeding 800 microns. The HydroFloat is able to maximize recovery of the value in this coarse particle size range while simultaneously creating a throw-away coarse tailings stream.

A significant benefit of this approach is that the amount of grinding is greatly reduced. Simulations show that energy consumption can be reduced or mill throughput can be increased by as much as 20-25% depending on the application.



Recovers virtually all particles which exhibit greater than 1% hydrophobic surface expression

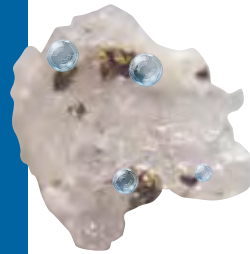


Illustration of multi-bubble attachment to exposed minerals



Rejects only those particles that have no hydrophobic surface expression



1% SURFACE EXPRESSION

High-resolution 3-D x-ray microtomography (HRXMT) results show that only 1% hydrophobic surface expression is needed to recover multi-phase particles up to 800 microns. This finding allows mineral processing engineers to re-think their traditional concentrator flowsheet.



HYDROFLOAT® SEPARATOR TIMELINE

1997

Early Work

Conducted under various test programs in the phosphate and potash industries.

2000

US Patent Granted

July 30, 2002 Air-Assisted Density Separator (US 6,425,485 B1) for carrying out flotation in the presence of a fluidized bed.

1st Industrial Order

April 2004 for the recovery of coarse potash (+3.5 x 0.8 mm) at Potashcorp's Rocanville potash beneficiation mill. Nearly 50 units in service/sold to date.

BENEFITS OF COARSE PARTICLE FLOTATION

Reduced Energy and Media Consumption

With the HydroFloat, it is no longer necessary to grind 100% of the ore to complete liberation. The HydroFloat can recover minerals at a coarse size needing only a minimal hydrophobic surface expression to effect a separation. As a result, maximum recovery is achieved at the coarsest possible size such that a larger portion of the ore is rejected from the plant at the coarsest possible size. The savings are enormous considering comminution energy and media consumption represent a large portion of the plant's operating cost.

Greater Mill Throughput

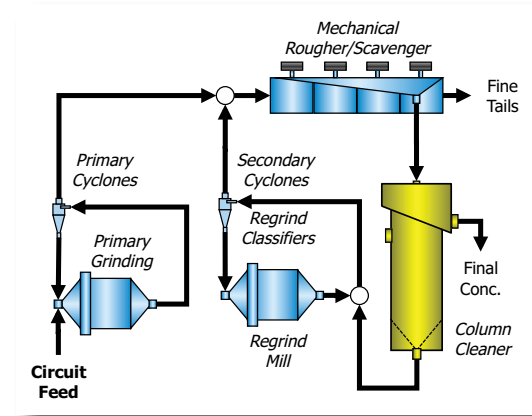
Implementing the HydroFloat results with a rejection of coarse (+150 microns) tailings. Additionally, the ability to recover coarse values provides an opportunity to increase the flotation feed particle top size. Unloading the grinding circuit and increasing the primary cyclone cut point results in a substantial increase to mill capacity. In fact, recent findings show mill capacity can be increased by more than 25 percent.

Sustainability, Safety & Environmental Benefits of Coarse Flotation

The ability to float coarse particles minimizes grinding requirements as only a small fraction of the feed is ground to the traditional liberation size – reducing energy consumption or increasing mill capacity. With maximum production of coarse reject material, the ability to manage tailings is vastly improved. The coarser tailings particle size distribution improves water drainage and can reduce impoundment size – minimizing environment risks.

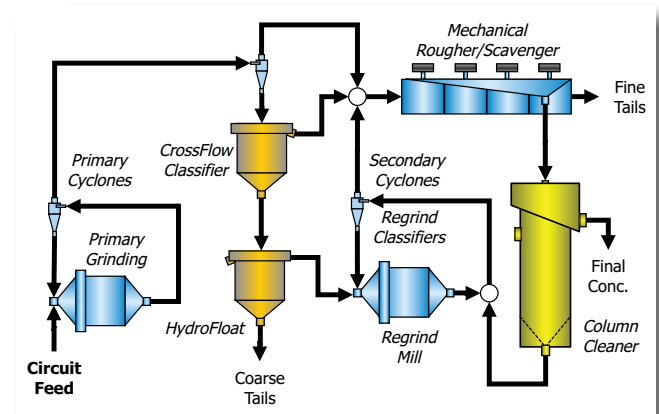


Traditional Copper Sulfide Circuit



A traditional circuit requires grinding 100% of the ore to sufficient liberation for recovery in conventional flotation circuits.

Future Circuit with the HydroFloat™ Separator



The HydroFloat Separator rejects "coarse" tailings eliminating much of the circulating load and increases mill throughput.

A coarse tailings particle size distribution offers benefits in tailings management (image Cariboo Regional District)

2005

International Exposure

Presented at 2000 IMPC in Rome and then again in 2005 at the Flotation Centenary Symposium in Brisbane, Australia.

2010

Extensive Testing

Sulfide applications

2015

1% Surface Expression Confirmed

HRXMT results indicates as little as 1% surface expression needed for nearly complete recovery of 850x500 micron multiphase particles.

PRINCIPLE OF OPERATION

The **HydroFloat** is an aerated, fluidized-bed (or teeter-bed) separator. The synergistic effect of combining flotation with gravity concentration results in an outcome that cannot be achieved by either approach alone.

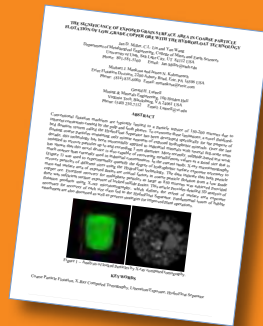
Air bubbles are dispersed by the fluidization system, percolate through the hindered-setting zone and attach to the hydrophobic component rendering it sufficiently buoyant to float and be recovered. The use of the dense phase, fluidized bed eliminates axial mixing, increases coarse particle residence time and improves the flotation rate through enhanced bubble-particle interactions. As a result, the rate of recovery is high for both fully-liberated and semi-liberated particles.

HydroFloat Separators Improve Coarse Particle Recovery by:

- Maximizing bubble/particle collision rates
- Maximizing particle residence time
- Minimizing axial mixing
- Minimizing turbulence
- Minimizing froth buoyancy restrictions



For more details download these white papers at www.EriezFlotation.com



SIGNIFICANCE OF EXPOSED GRAIN SURFACE AREA IN COARSE PARTICLE FLOTATION OF LOW-GRADE GOLD ORE WITH THE HYDROFLOAT™ TECHNOLOGY



RECOVERY OF VALUES FROM A PORPHYRY COPPER TAILINGS STREAM



SPLIT-FEED CIRCUIT DESIGN FOR PRIMARY SULFIDE RECOVERY



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