A Method for Profiling Magnetic & Gravity Response of Metalliferous Ore Using Data from Mineralogic Mining®

James Strongman¹, Jake Harrison¹, Benjamin Tordoff²
¹Petrolab Ltd., ²Carl Zeiss Microscopy Ltd.
Petrolab Limited

- 20 years of consultancy to the mineral processing and mining industries
- Specialist in both mineralogical consultancy and commercial section preparation
- Team of innovative and forward thinking mineralogists, geologists and technicians
- Our core clients are mineral processors and mining consultants – We understand their questions and how to get the answers
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Mineral Processing

- Mineral processors look to identify a distinct difference between target mineral and gangue.

- Four principle separation techniques
  - Flotation
  - Leaching
  - Gravity
  - Magnetic

- Case study selected – Gravity and Magnetic profiling of a tungsten Ore test product

- Study objective – Assess and predict the feed and products response to gravity and magnetic separation
Gravity Separation

- Key physical separator - Density g/cm³

Typical density difference across a tungsten ore would be between 2.65 g/cm³ Quartz and Wolframite 7.3 g/cm³.

Test program used a Holman 2000 shaking table, capable of splitting on a s.g difference of ~1 g/cm³.
Particles not Minerals

- Particle will respond with combined properties of the contained minerals

Gravity

- Haematite: 5.3 s.g (10%)
- Quartz: 2.65 s.g (45%)
- Magnetite: 5.13 s.g (45%)
- Particle: 4.47 s.g
Analysis Method

Optimisation of microscope conditions, acceleration voltage and brightness/contrast;

Zeiss EVO MA 25 LaB6-SEM with 60mm² X-FlashN detector 20KV pixel size 5 µm

- BSE Thresholding and Image analysis algorithms

Define and segregate particles

- Analysis High resolution BSE image of each particle and EDS data of each pixel

Process time 0.04s (~5,000 counts) per spectra
2k – 5k Particles - runtime 3 hours
Gravity Results

- Feed Profile

![Graph of Gravity Results](image-url)

Rougher Gravity feed +250 µm

CUMULATIVE RECOVERY vs. SPECIFIC GRAVITY

Sample
Wolframite
Ferberite
Cassiterite
Ilmenite
Haematite
Magnetite
Ferro-Mag
Quartz
<table>
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<tr>
<th>Conc 1</th>
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Gravity Results
Results Profiles
Magnetic Separation

- Key physical separator – Magnetic response

Typical magnetic response of minerals in a tungsten ore can be between Quartz and Magnetite.

Test program used a Carpco HIM induced roll separator, which can split differences of magnetic susceptibility ~0.1(A)
Particles not Minerals

- Particle will respond with combined properties of the contained minerals

Gravity

- Electro-magnetic response
Magnetic Results

LIMS

0.1T

0.2T

0.4T

0.6T

Non-Mag
Results
Summary

- Process particles not minerals, the combined properties of each particle must be considered when predicting how it will respond.

- Profile will show the key separation points and also overlaps.

- Mineralogic is not only provides fully quantitative EDS analysis, but also is based in an MSQL data structure allows detailed integration of the data.

- Study of the particles outside of the predicted response to lead to improved separation.

 Future

- Routine analysis in operating plants to build trending data sets to optimize circuits against feed mineralogy/ore type.

- Assignment of probability against particle parameters to build simulation models.

- Development of the magnetic separation profile by incorporating the effect of density of non-magnetic phases on para-magnetics.
Thank you for your attention

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for further information
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