Metal recovery from low grade ores and side streams

Mineral Economy Stakeholder Seminar
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Metal recovery potential

Currently economic reserves

Known uneconomic reserves

Low-grade ores, tailings, metallurgical wastes etc.

Unknown reserves

Technology development potential

Exploration potential
Low-grade and complex resources in focus

PROCESS DEVELOPMENT AND MODELLING

Metal extraction → Pre-treatment → Metal recovery

INFRASTRUCTURE DEVELOPMENT

EFFICIENT RECOVERY OF METALS FROM

- Sulphidic ores
- Oxidic ores
- Tailings
- Industrial sidestreams
- Consumer goods
Leaching of low grade materials
-
Examples

- Low grade polymetallic deposits
- Vehicle shredder residue
- Mine tailings
- Phosphorous ores and wastes
- MSWI bottom ash:
  - 0,47% Cu
  - 0,38% Zn
  - 0,03% Ni
  - 0,04% Cr
- Mobile phone PCB:
  - 80-1000 ppm Au
  - 110-3300 ppm Ag
  - 10–27% Cu, 1,5–7% Al, 1–8% Fe
Work towards industrial implementation: Efficient recovery of metals from tailings

ECOTAIL PROJECT

- 2016 - 2018
- Large amounts of metals left in tailings
- Generally hazardous waste due to metal content
- No need for excavation and grinding
- Reduced risk for acid mine drainage
- Additional source of revenue
Processing of Jarosite waste

- Jarogain project
- Pre-feasibility study for a plant processing 400 000 t/y jarosite

<table>
<thead>
<tr>
<th>Component</th>
<th>Content</th>
<th>Annual production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pb</td>
<td>3%</td>
<td>12 000 t</td>
</tr>
<tr>
<td>Zn</td>
<td>2%</td>
<td>8 000 t</td>
</tr>
<tr>
<td>Ag</td>
<td>150 g/t</td>
<td>60 000 kg</td>
</tr>
<tr>
<td>Au</td>
<td>0,5 g/t</td>
<td>200 kg</td>
</tr>
<tr>
<td>In</td>
<td>100 g/t</td>
<td>40 000 kg</td>
</tr>
<tr>
<td>Ga</td>
<td>40 g/t</td>
<td>16 000 kg</td>
</tr>
<tr>
<td>Fe</td>
<td>15%</td>
<td>60 000 t</td>
</tr>
<tr>
<td>Fe$_2$O$_3$</td>
<td></td>
<td>86 000 t</td>
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</tbody>
</table>
METGROW+: METAL RECOVERY FROM LOW-GRADE ORES AND WASTES PLUS

- 4 years (1.2.2016 - 31.1.2020)
- 7.9 M€, 19 partners from 9 member states
EUROPEAN UNION
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690088.
FOUR SELECTED LOW-GRADE RESOURCE FAMILIES

Material streams in METGROW+ project: yearly production rates in the EU

- **Low grade ores**
  - 2,000,000 tonnes/year
  - Estimated concentration:
    - Cobalt: 0.08%
    - Nickel: 1.3%

- **Fine grained landfilled sludges**
  - 1,000,000 tonnes/year
  - Elements:
    - Chromium: 4.0%
    - Nickel: 1.6%

- **Iron rich sludges**
  - 500,000 tonnes/year
  - Elements:
    - Copper: 29%
    - Zinc: 29%
    - Lead: 82%
    - Gallium: 0.005%
    - Arsenic: 0.001%
    - Sb: 0.05%
    - Sn: 0.001%

- **Fayalitic slags**
  - 2,950,000 tonnes/year
  - Elements:
    - Copper: 29%
    - Lead: 82%
    - Zinc: 29%
    - Gallium: 0.005%
    - Arsenic: 0.001%
    - Sb: 0.05%
    - Sn: 0.001%

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Primary and secondary resources containing base and critical metals

- Low grade ores & tailings
  - METGROW+: laterites
- Sludges
  - METGROW+: goethite/jarosite & Cr-rich sludges (stainless steel)
- Slags & dusts
  - METGROW+: fayalitic slags

Pretreatment (WP2)

Metal extraction (WP3)

Metal recovery (WP4)

Matrix conversion (WP5)

1. comminution beneficiation
2. physical separation
3. hydroflex
4. bio-leaching
5. biosolvo
6. plasma-pyro
7. physicochem
8. biosorption & precipitation
9. (bio)electrowinning

10. scm
11. geo-pol
12. others

Residue matrix valorisation

“Apart from the metal recovery, METGROW+ will create additional value by the valorisation of the matrix material”
TECHNOLOGY FOR BUSINESS