Integrated mineral technologies for more sustainable raw material supply

Acronym: ITERAMS

Abstract / executive summary:

ITERAMS aims at i) increasing water circulation and developing mineral processes with significantly reduced consumption of water, and ii) minimizing the amount of landfilled waste material. ITERAMS develops an understanding of the interaction of mineralogy and water properties in dynamic water recycling conditions. Methods for closed water circuits will be developed. The consortium creates technologies to produce geopolymers out of ground tailings.

Links to the Strategic Implementation Plan:

• I. Technology Pillar
  ○ I.B Priority Area: Technologies for primary and secondary raw materials’ production
    • Action area n° I.3: Innovative extraction of raw materials
      • 2) Mining of small deposits
    • Action area n° I.4: Processing and refining of raw materials
      • 1) Innovative and flexible processing

Coverage of the Action Areas referred to above:

Action area I.3: Innovative extraction of raw materials
Mining of small deposits: Developing cost effective and environmentally sound concepts and solutions for exploitation of small or low-grade mineral deposits with pre-processing and refining capacities in their vicinity, using the assets of a larger mine or flexible and mobile mining technologies.
ITERAMS solution: ITERAMS gives valuable input to develop further the modular c-plant concept with closed water circuits and dry tailing systems to enable efficient and low cost project development and site remediation. The approach to be developed reduces both capital expenditure and operational costs.

Action area I.4: Processing and refining of raw materials
Innovative and flexible processing: Developing new economically viable flexible, and where
appropriate mobile or modular, processing solutions, for lower grade and complex ores and industrial residues, industrial and construction minerals and wood-based fibres, of different size of particles, able to process different raw materials in the feed with higher recovery rates and with minimal wastes, and minimal energy and water consumption to provide better separation and higher recovery rates while utilising the potential of unconventional or hybrid technologies.

ITERAMS solution: Significant savings in water and use of consumables will be gained by the novel ITERAMS methodology. Higher metal recovery rates are enabled by tuning the water usage specifically according to the given process step. Additional revenues will be gained from the methods for valorisation of tailings.

**Objectives of the commitment:**

The objectives are to i) increase water circulation and develop processes with significantly reduced consumption of water, and ii) to minimize the amount of landfilled waste material. The objectives of ITERAMS are to
1. Isolate the process water use from the adjacent water system.
2. Minimise the use of energy, water and consumables in relation to final valuable products by being able to physically manipulate the mill feed stream properties.
3. Have a marked portion of waste rock and tailings either used for added revenue as hardening mine fill or sold as products.
4. Have all tailings, not used as described above, safely deposited dry, under a landscaped geopolymerized cap having very low water penetration and oxygen diffusion.

**Description of the activities:**

ITERAMS will develop an understanding of the interaction of mineralogy and water properties in dynamic water recycling conditions. Methods for closed water circuits will be developed. The consortium creates technologies to produce geopolymers out of ground tailings.

**Description of the expected impacts:**

Resource efficiency in the mining and metallurgical industry is improved, when water is more efficiently recycled in the processes and waste materials are converted into valuable products. Public acceptance can be improved through reduced environmental impact of mining and less competition for same water resources. Developed modular plants with closed water circuits and dry tailing systems enable efficient and low cost project development and site remediation. The approach to be developed reduces both capital expenditure and operational costs. Using water specifically tuned to suit a given process step, is expected to give higher recovery rates.

**Expected innovation outcomes:**

New products to the market
New processes
New services
New technologies

**Name of the coordinating organisation:**

VTT Technical Research Centre of Finland Ltd

**Country:**

Finland

**Entity profile:**

Governmental/public body

**Role within the commitment:**

Other partners:

Name of partner: Outotec Oyj
Country: Finland
Entity profile: Private sector - large company
Role within the commitment: Process concept development and validation protocol design for water circulation and tailings valorization.

Name of partner: Kevitsa Mining Oy
Country: Finland
Entity profile: Private sector - large company
Role within the commitment: Industrial partner, providing sample materials to be used and serving as a test site for technologies developed within the framework of ITERAMS. Will provide industry guidance on its expectations and adjudicate on applicability of project results in real mine operations.

Name of partner: Aalto University Foundation
Country: Finland
Entity profile: Academia
Role within the commitment: Development of protocols for the evaluation and implementation of alternatives for water saving in mineral processing operations with special focus on flotation. The protocol shall give guidelines for the monitoring and evaluation of the critical water quality related parameters. Evaluation and testing of water treatment recycling unit operations, by investigation of the DAF (Dissolved Air Flotation) unit process for removal harmful impurities.

Name of partner: Montanuniversität Leoben (University of Leoben)
Country: Austria
Entity profile: Academia
Role within the commitment:
Development and implementation of a technology to apply the concept of geopolymerisation to tailings in order to make it possible to use the tailings as backfill for mining.

**Name of partner:** Lappeenranta University of Technology  
**Country:** Finland  
**Entity profile:** Academia  
**Role within the commitment:** LUT will contribute to the increased efficiency of treatment of tailings and process waters through advanced dewatering processes and water purification methods, e.g. adsorption, membrane separation, precipitation and ion exchange.

**Name of partner:** BRGM  
**Country:** France  
**Entity profile:** Governmental/public body  
**Role within the commitment:** Evaluation and modelling of water treatment processes.

**Name of partner:** Ima Engineering Ltd Oy  
**Country:** Finland  
**Entity profile:** Private sector - SME  
**Role within the commitment:** Ima Engineering provides expertise in sampling and in on-line analysis technologies from the blast hole samples, and on-line analysis of primary crushed ore immediately after the crushing enabling ore sorting to ore and waste, which reduces waste going into the concentrator. Additionally analytical bulk sorting will in future enable possibilities to differentiate ore (mineralogy) qualities to be used for instance in geo-polymerization.

**Name of partner:** Somincor  
**Country:** Portugal  
**Entity profile:** Private sector - large company  
**Role within the commitment:** Industrial site for investigation and implementation of successful applications of the project.
Name of partner: Anglo American Services (UK) Ltd
Country: United Kingdom
Entity profile: Private sector - large company
Role within the commitment: Providing metallurgical samples and potential sites for proof of concept for reduction in water consumption in platinum and copper processing. Input and advice on the economic viability of the ideation and concept development during the initial phases of the project.

Name of partner: Hacettepe Mineral Technologies
Country: Turkey
Entity profile: Private sector - SME
Role within the commitment: Increase water circulation in flotation plant without affecting flotation performance. Developing measurement tools for on-line monitoring of water quality in mine sites.

Name of partner: University of Oulu
Country: Finland
Entity profile: Academia
Role within the commitment: Utilization of mine tailings in geopolymer materials. Development of novel, safety methods to storage tailings and development of new products.

Name of partner: Amphos 21 Consulting (Amphos 21)
Country: Spain
Entity profile: Private sector - SME
Role within the commitment: Assessing the effects of new technologies on the natural water cycle (reducing impacts on water quality and reducing the use of fresh water in arid zones). Finding new business models with the applications developed in the frame of the project.

Existing EU contribution: No
Period to implement the commitment:  
Tuesday, 1 March, 2016 to Thursday, 31 December, 2020