European Innovation Partnership on Raw Materials

Application for a Raw Materials Commitment

Metal Recovery from Low Grade Ores and Wastes

Acronym:
MetGrow

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.4: Processing and refining of raw materials
      • 1) Innovative and flexible processing
      • 2) Metallurgical systems

Objectives of the commitment:

The objectives are to improve i) recovery of metals from complex sources, low grade ores and industrial residues and ii) resource efficiency in downstream processing. There is no economic value (or the value is negative) in low grade ore bodies and industrial residues until new economic methods are provided to extract them. Bio/hydro/pyrometallurgical beneficiation processes are developed in a holistic and integrated way to improve resource use and to minimize and ultimately to prevent hazardous waste and acidic mine drainage in mining industry. New recycling concepts for metal containing wastes are developed. The aim is to extend Europe’s effective resource base for different metals from nonconventional primary and secondary resources for valuable and critical metals, and to turn waste into a valuable resource and valorization of the waste and residue after extraction of valuables.

Description of the activities:

Bio/hydro/pyrometallurgical processes and their novel combinations are developed to reduce the amount of needed raw materials, resources and produced waste materials in the mining and metallurgical industry. Our development focus is on enabling hydrometallurgical technologies (leaching, precipitation, cementation, liquid-liquid extraction, electrochemistry, and bioprocessing) for treatment of solid and liquid waste streams (characterization, improved recycling, stabilization of hazardous waste, and safe landfills). Innovative hydrometallurgical process concepts and hybrid methods will be developed for the recovery of metals from low grade and complex sources. For example bioprocessing could be combined with other hydrometallurgical unit processes. Flexible mobile units for small deposits and waste areas will be developed, in order to possibly integrate different of these techniques and unit in a flow sheet for treating specific streams and ores.
Reduction of water and energy consumption and reuse of water are taken into account in process development work. Water usage in the developed hydrometallurgical processes will be minimized and as much water as possible will be recirculated in the process. Process development is accompanied by advanced thermodynamic modelling and flowsheet simulations. New value chains and business models will be created. All developed technologies will be evaluated on their resource efficiency.

**Description of the expected impacts:**

Resource efficiency in the mining, waste treatment, and metallurgical industry is improved. Moreover, significant amounts of industrial residues (both solid and aqueous) will possibly be valorized.

Supply of metals from unconventional resources to reduce Europe’s dependence on import of metals. Valorization of waste materials into valuable products.

New industrial flow sheets for waste and ores processing for optimal material recovery and business creation with simultaneous job creation in Europe.

Public acceptance can be improved through reduced environmental impact of mining.

**Expected innovation outcomes:**

- New products to the market
- New processes
- New technologies
- New business models
- New ideas to the market

**Comments:**

Technologies to produce various metals and critical elements (REE, PGM, Au, Cu, P etc.) from low grade and/or complex residue sources, nowadays considered as wastes, are developed. These technologies should be developed first on a lab scale and later on pilot scale. Flow sheets integrating different techniques will be developed to optimize recovery of valuable materials from low grade ores and wastes. Resource efficiency in downstream processing is improved. The results can extend Europe’s effective resource base for different critical and valuable materials such as REEs, PGMs, Au, Cu, and P for example. Overall, the utilization of wastes and side streams in the mining industry is increased. New businesses and employment can be created based on waste valorization.

**Name of the coordinating organisation:**

VTT Technical Research Centre of Finland

**Country:**

Finland

**Entity profile:**

Governmental/public body

**Role within the commitment:**

Innovative hydrometallurgical process concepts and hybrid method development for complex and low grade resources. Development of flexible mobile units for small deposits and waste areas.


**Other partners:**

**Name of partner:**
Instytut Metali Niezelaznych (Institute of Non-Ferrous Metals)

**Country:**
Poland

**Entity profile:**
Governmental/public body

**Role within the commitment:**
Running activities related to laboratory and pilot scale studies into ore treatment and metallurgical metal recovery.

**Name of partner:**
VITO Vision on Technology

**Country:**
Belgium

**Entity profile:**
NGOs

**Role within the commitment:**
Separation and recovery of valuable and critical raw materials (e.g. metals) from industrial residues by hydrometallurgical routes with the aim to recycle both the recovered metals as well as the matrix material. (i) physical separation technology with a focus on fine grained (mineral) materials; (ii) hydrometallurgical separation by state-of-the-art equipment and techniques; and (iii) hydrometallurgical recovery by electrochemical selective recovery of critical metals from (leaching) solutions using bio- or chemical catalysts.

**Name of partner:**
IDP INGENIERIA Y ARQUITECTURA IBERIA SL.

**Country:**
Spain

**Entity profile:**
Private sector - SME

**Role within the commitment:**

**Name of partner:**
Technical University Crete, School of Mineral Resources Engineering (TUC)

**Country:**
Greece

**Entity profile:**
Academia

**Role within the commitment:**
Development / improvement of (bio)hydrometallurgical processes for the recovery of metals (including rare ones) from low grade ores, mining and metallurgical wastes including red mud, poor laterite ores and metallurgical slags. Advanced characterization of mining and metallurgical wastes, assessment of waste valorization potential, risk and LCA studies.
Name of partner: KU Leuven  
Country: Belgium  
Entity profile: Academia  
Role within the commitment: 
Recycling of rare earths  
Recovery of valuable metals from aqueous waste streams and leachates by supported ionic liquid phases (ionic liquids immobilized on a solid support)  
Applications of ionic liquids in hydrometallurgy: extraction and separation of metals  
Biobased adsorbents for the recovery of valuable metals from aqueous waste streams  
Slag engineering: concentration of valuable metals in certain mineral phases, valorisation of the residue in value added products (aka building materials)  
Use of electrochemical methods for the selective recovery of valuable metals from aqueous waste streams  
Ultrasound-assisted leaching of valuable from low grade ores and industrial residues  
Photoreactors for metal separations  
Economic modelling and environmental impact assessment (LCA) of recycling technologies, materials flow analysis  
Thermodynamic modelling

Name of partner: SIEMCALSA (Sociedad de Investigación y Explotación Minera de Castilla y León, S.A.)  
Country: Spain  
Entity profile: Private sector - SME  
Role within the commitment: 
SIEMCALSA is developing several exploration mining projects, in our own mining rights, on W, Sn, polymetallics (Cu, Zn, Ag, Sn, W), Pb-Zn and Cu-Co-Ni-Au. Metallurgical testworks are being carried out in some of these projects.

Name of partner: Ghent University  
Country: Belgium  
Entity profile: Academia  
Role within the commitment: 
Recovery of valuable materials from aqueous wastestreams; biometallurgy; study of valuable elements in slags; indicators for resource efficiency in materials cycles.

Name of partner: General Mining & Metallurgical S.A. LARCO  
Country: Greece  
Entity profile: Private sector - large company
Role within the commitment:
End user for the innovative hydrometallurgical processes on low grade Ni ores.

Name of partner:
SP Technical Research Institute of Sweden/ non-profit research organisation
Country:
Sweden
Entity profile:
Governmental/public body
Role within the commitment:
Bioprocessing of ores and waste materials, recovery of metals from complex materials and ashes. Development of demonstration unit for metal recovery from ashes. Connections to the energy (waste-to-energy) sector. System analysis.

Name of partner:
FUNDACION TECNALIA RESEARCH & INNOVATION
Country:
Spain
Entity profile:
Governmental/public body
Role within the commitment:
Hydrometallurgical/pyrometallurgical processes development for complex and low grade resources (for example residues from thermal processes) to extract critical and other valuable metals. From lab scale to small pilots prior to demonstrator scale. Characterisation of input waste and output products quality for their valorisation; environmental impact evaluation in further applications of the new non-hazardous waste or evaluation of properties for landfill deposition if needed.

Name of partner:
FUNDACION CARTIF
Country:
Spain
Entity profile:
Governmental/public body
Role within the commitment:
Puryfing industrial wastewater, wastewater reutilization.

Name of partner:
Stiftelsen SINTEF
Country:
Norway
Entity profile:
Governmental/public body
Role within the commitment:
RTO with competence on high temperature metallurgical processes. Electrochemical methods.

Name of partner:
IDENER (Optimización orientada a la sostenibilidad S.L.)
Country: Spain
Entity profile: Private sector - SME
Role within the commitment:
Copper industry process modelling and optimisation in order to achieve resource efficiency (energy, chemicals and reagents, water); Germanium recovery from flyashes development through hydrometallurgical techniques and optimisation of the developed process through multidisciplinary design optimisation.

Name of partner:
BIOENER BIERZO
Country: Spain
Entity profile: Private sector - SME
Role within the commitment:
BIONERBIERZO S.L is a Spanish enterprise, part of Viloria Lamelas Group (devoted to mining, energy, and consulting engineering) which is working on developing economically and environmentally sustainable methods of purifying acid mine drainage and metals recovery from purified sludge, also being energy efficient.

Existing EU contribution:
Yes
Source: FP 7
Cohesion Policy Funds: Cohesion Fund
Period to implement the commitment:
Saturday, 1 February, 2014 to Friday, 31 August, 2018