E R A·M I N 2

RESEARCH & INNOVATION PROGRAMME ON RAW MATERIALS
TO FOSTER CIRCULAR ECONOMY

ERA-MIN JOINT CALL 2019

CATALOGUE OF PUBLISHABLE SUMMARIES

OF FUNDED PROJECTS

September 2020

Co-funded by the Horizon 2020 programme
of the European Union

ERA-MIN 2 comprises a progressive, pan-European network of 21 public research funding organisations from 18 countries/regions (Argentina, Belgium-Flanders, Brazil, Chile, Finland, France, Germany, Ireland, Italy, Poland, Portugal, Romania, Slovenia, South Africa, Spain, Spain-Castilla y Léon, Sweden and Turkey).

Built on the experience of the EU project ERA-MIN (2011-2015), **ERA-MIN 2** aims to enhance and strengthen the coordination of research and innovation programmes in the field of non-energy, non-agricultural raw materials (construction, industrial and metallic minerals) to support the European Innovation Partnership on Raw Materials, the EU Raw Materials Initiative and further develop the raw materials sector, in Europe and globally, through funding of transnational research and innovation (R&I) activities.

ERA-MIN 2 will support demand driven research on primary and secondary resources, and substitution of critical raw materials under a circular economy approach, to give the opportunity to the R&I community to apply to world-wide coordinated funding, gaining access to leading knowledge and new markets, while reducing fragmentation of R&I funding across Europe and globally. This will be achieved through one EU co-funded call for R&I proposals in 2017 and two additional calls, in 2018 and in 2019, designed and developed specifically for the non-energy, non-agricultural raw materials sector.

Acronym: ERA-MIN 2
Title: Implement a European-wide coordination of research and innovation programs on raw materials to strengthen the industry competitiveness and the shift to a circular economy
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Duration: 60 months

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TABLE OF CONTENTS

Contents

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1 INTRODUCTION

A total of 19 funding organisations participated in the third **ERA-MIN Joint Call 2019** on "*Raw materials for sustainable development and the circular economy*" launched on 15th of November 2019. This call was a one-step submission procedure and considered the lessons learnt from Call 2017 and 2018. A total budget of €10.3 million was committed and the proposal submission deadline was 12th of March 2020. Considering the ranking list of proposals as recommended by the assessments of the Scientific Evaluation Board and the available national and regional public funds, the Call Steering Committee selected 12 transnational R&I projects for funding. The results were communicated on 9th of July 2020 and the projects will start in December 2020 at the latest and run for 24-36 months. More information on the Call topics and procedures is available at a dedicated webpage: https://www.era-min.eu/joint-call/era-min-joint-call-2019 . The Call statistics are detailed in a public deliverable D7.8.
The **ERA-MIN Joint Call 2019** was focused on needs-driven research on non-energy, non-agricultural raw materials (metallic, construction and industrial minerals), with a circular economy approach.

The five main topics of the call were based on the challenges and priorities identified in the ERA MIN Research Agenda covering both primary and secondary resources and substitution of Critical Raw Materials. Each main topic had several sub-topics, the project proposals addressed one main topic each and reported what sub-topic the proposal was related to. Proposals could relate to more than one sub-topics outside the main topic addressed.

1. **Supply of raw materials from exploration and mining;**
2. **Design;**
3. **Processing, Production and Remanufacturing;**
4. **Recycling and Re-use of End-of-Life products;**
5. **Cross-Cutting Topics.**

The Joint Call topics are in line with the integrated strategy proposed in the EU Raw Materials Initiative, the Strategic Implementation Plan of the European Innovation Partnership on Raw Materials and the EU Circular Economy Package.

This report contains the publishable abstracts of the 12 funded projects grouped by main call topic addressed even though many projects are multidisciplinary by covering other sub-topics.

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2 PUBLISHABLE ABSTRACTS OF FUNDED PROJECTS

TOPIC 1 - SUPPLY OF RAW MATERIALS FROM EXPLORATION AND MINING

nanoBT

Project acronym	**nanoBT**		
Project title	Application of nano-bubble technologies to mining industry operations		
Main topic	**1. Supply of raw materials from exploration and mining**		
Sub-topics	1.3 Mine closure and reclamation; 3.2 Increase resource efficiency through recycling of residues or remanufacturing of used products and components; 5.3 Social acceptance and trust/public perception of raw materials		
Keywords	Nanobubbles, biochar, phytoextraction, effluent desalination, ion metallurgy		
Publishable abstract	Metals are strategic elements that support modern life as we know it; metals are extracted from natural resources and used in numerous products, and high-tech modern applications. Access to safe and clean drinking water and sanitation was recognized as a human right by UN in 2010. Water occupies 70.8% of our planet's surface; however, only ~3% of that is fresh, making it a scarce commodity. To make things worse, during the last century, it was shown that we are using water much faster than nature can replenish it. Metal extraction and recovery is energy-intensive, requires large volumes of water, and results in large amounts of toxic wastes being disposed in the environment. The establishment of green mining in Europe takes more than just sheer will; it requires "change of heart" and public acceptance for a sector with a legacy of polluting accidents. nanoBT introduces the development of innovative energy efficient green processes and has the following objectives: to recover both water and metals from mining wastes by taking advantage of the combined power of ultra-fine-bubble technology and the nature. It is proposed to recover water in the form of ice-like water-CO2 structures. This technology is more energy efficient than conventional state-of-the-art desalination technologies and can be applied to mine tailings ponds. Further, it is proposed to treat the resulting dewatered brines to selectively recover the residual metals using green non-toxic biodegradable solvents in a continuous process. Finally, biochar-assisted phytoremediation is applied to extract metals from solid mine wastes using halophytes with increased efficiency and render spoils non-hazardous. Through the concerted action of 3 partners from CA, SA and GR the anticipated impact is high in technology, circular economy, and quality of life. These technologies aim to revitalize mining in Europe, as a sustainable green sector improve its strategic importance and safeguard its social acceptance.		
Participating organisations	1. Coordinator: Technical University of Crete (Greece) 2. Fine Bubble Technologies (Pty) Ltd (South Africa) 3. Université Laval (Canada)		
Project duration	36 Months (11 /2020 to 10/2023)		
Total Costs	€529,235	**Total Requested Funding**	€516,465

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MOSTMEG

Project acronym	**MOSTMEG**		
Project title	Predictive models for strategic metal rich, granite-related ore systems based on mineral and geochemical fingerprints and footprints		
Main topic	1. Supply of raw materials from exploration and mining		
Sub-topics	1.1 Exploration		
Keywords	Strategic metals; Granite-related deposits; Mineral and geochemical proxies/vectors; Metallogenicmodelling; Prospectivity mapping		
Publishable abstract	Granite-related ore deposits are the source of a large number of metals used in industrial applications. Foreseeable supply shortages or disruptions of such metals and the pressing need to enhance EU domestic production should lead to significant investment in mineral exploration, re-evaluating known mining districts and surveying other promising areas. Notwithstanding the past granite-related mining activity in the European Vatican Belt, which provided considerable geological knowledge, comprehension of the factors ruling rare metal enrichment in aplito-pegmatite swarms and W-(Sn) high-grades in magmatic-hydrothermal ore systems related to peraluminous granites is still inadequate to fully constrain the genesis of productive ore systems and to design dependable models for modern exploration. The main goal of MOSTMEG project is to develop and validate predictive models for strategic metal-rich, granite-related ore systems by refining available concepts and exploration strategies, and using mineral and geochemical/isotopic criteria as pathfinders or vectors to mineralized systems, as well as geochronological data to constrain magma emplacement and cooling history, and the main ore stages. Such models will make it possible to predict or recognize: (i) promising litho-stratigraphic sections and/or granite suites, and their potential metal content; (ii) different mineralization types; (iii) the relevant processes of metal concentration and deposition controlling high-grade ores; and(iv) mineral assemblages potentially enriched in valuable by-products. The case studies proposed include brownfields of different granite-related ore systems and promising green fields, and illustrate common scenarios in the Iberian Variscides, specifically in the Segura-Argemela-Panasqueira-Góis strip. This proposal provides innovative R&D paths to adjust exploration strategies in order to enhance EU domestic production of some mineral raw materials.		
Participating organisations	1. Coordinator: Faculdade de Ciências da Universidadede Lisboa (Portugal) 2. Faculdade de Ciências do Porto (Portugal) 3. Universidade de Évora (Portugal) 4. Laboratório Nacional de Energia e Geologia, I.P. (Portugal) 5. Universidade de Coimbra (Portugal) 6. CNRS-GeoRessources (France) 7. Instituto de Geociencias da Universidade S. Paulo (Brazil)		
Project duration	36 Months (11/2020 to 10/2023)		
Total Costs	€851,946	**Total Requested Funding**	€412,755

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D-Rex

Project acronym	**D-Rex**		
Project title	Deposit-to-Regional Scale Exploration		
Main topic	1. Supply of raw materials from exploration and mining		
Sub-topics	1.1 Exploration		
Keywords	geophysics, mineral exploration, lithosphere, modelling, data integration		
Publishable abstract	Formation and concentration of metals into economic mineral deposits requires a combination of processes operating at different scales. Mineral deposits are a small part of a very large geological context, the so-called mineral system. Mineral Systems include an often deeply seated fluid source, source region for metals, energy source for driving hydrothermal systems, pathways for the migration of enriched fluids, require a depositional mechanism for the precipitation of metals into a deposit and a fluid outflow. Regional scale geophysical modelling can identify key markers indicative of economic metal endowment on a larger scale at mid-lower crustal depths. D-Rex will improve identification of metal endowment in previously unexplored areas. Surface geology of endowed and lesser endowed terranes is often broadly similar. This difference in endowment level must then result from either: a deeper burial depth of endowment beyond the sensitivity of traditional exploration techniques; or differing processes at mid-lower crustal depths leading to heterogeneity of the concentration of metals in the upper crust. Deeper looking regional studies are needed to compliment the deposit scale high resolution efforts to elucidate the disparate nature of metal endowment in areas characterised by similar surface geology. Large-scale 3D remodels provide insight into complex crustal geometries, tectonic evolution, identification of fluid pathways and the internal structure and geometry of mineral systems. The D-Rex approach will improve resource assessment and identification of previously unexplored endowed target areas. Construction of a meaningful regional model requires collection of complimentary 3D data sets sensitive to different physical properties. However, the integration of multiple data sets into a consistent model is difficult, requiring development of 3D inversion techniques capable of leveraging machine learning and multi-variate analyses of petrophysical parameters.		
Participating organisations	1. Coordinator: Luleå University of Technology (Sweden) 2. Geological Survey of Finland (Finland) 3. Czech Academy of Science (Czech Republic) 4. Earth Science Institute of the Slovak Academy of Sciences (Slovakia) 5. Luossavaara-Kiirunavaara AB (LKAB) (Sweden) 6. Bluejay Mining plc (U.K) 7. Loop and Line Oy (Finland) 8. Boliden Mineral AB (Sweden) 9. Boliden FinnEx Oy (Finland)		
Project duration	36 Months (01/2021 to 12/2023)		
Total Costs	€2,463,320	**Total Requested Funding**	€1,314,792

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TOPIC 3 - PROCESSING, PRODUCTION AND REMANUFACTURING

RETECH

Project acronym	**RETECH**		
Project title	Recovery of rare earth elements from complex ores in Turkey and their potential use in high tech industrial applications		
Main topic	3. Processing, Production and Remanufacturing		
Sub-topics	2.1 Product design for increased raw material efficiency; 2.4 Product design for critical materials substitution.		
Keywords	rare earth elements, solvent extraction, neodymium, magnet, advanced materials		
Publishable abstract	Rare earth elements (REEs) are strategic and critical elements, and vital components for dozens of high-tech industrial products including solar panels, electric vehicles, computers and smartphones, wind turbines, and phosphor lighting due to unique chemical and physical properties. The overall objective of the project is to conduct R&D studies and develop efficient technologies for valorisation of REEs from existing complex ores, which will contribute to establish a sustainable REE supply chain in Turkey and Europe. Through this project; mineralogical, chemical and metallurgical studies related to integrating a full-scale enrichment research on industrial R&D projects will be conducted in Turkey. This project brings the opportunity to supply an alternative source of REE for Europe and Turkey. Obtaining strategically important REE from a deposit located in Turkey nearby to Europe can reduce dependency of our country and EU to overseas markets, especially to China largest supplier by introducing an alternative source and also it can ensure to have a sustainable and competitive supply chain and/or supply security. Based on policy of EU and Turkey created for ensuring diversity in energy source reducing dependency on foreign energy, results of this study will provide socio-economic impact and it will lead important achievements in technological progress. During the project, a realistic supply chain alternative to China will be simulated from ores to high technology magnet applications. The project is expected to be implemented in mass scale after completion. Also, knowledge transfer will foster development and innovation. The project will bring new opportunities to researchers, young people, industry and general population, promoting the economic growth of the whole country and bringing new valuable relations in the European framework.		
Participating organisations	1. Coordinator: RARE EARTH ELEMENTS RESEARCHINSTITUE (Turkey) 2. National R&D Institute for Nonferrous and Rare Metals (Romania) 3. General Directorate of Mineral Research and Exploration (Turkey) 4. Rumelisiad Girisim A.S. (Turkey) 5. INCDMRR (Romania)		
Project duration	36 Months (12/2020 to 11/2023)		
Total Costs	€642,000	**Total Requested Funding**	€567,000

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ReFina

Project acronym	**ReFina**		
Project title	Novel methods for enhanced recovery of metals and minerals from fine incineration ash		
Main topic	3. Processing, Production and Remanufacturing		
Sub-topics	3.1 Increase resource efficiency in resource intensive production processes; 3.2 Increase resource efficiency through recycling of residues ore manufacturing of used products and components; 4.3 Recovery of raw materials from End-of-life products.		
Keywords	bottom ash, non-ferrous metals, recovery, fine fraction		
Publishable abstract	Waste-to-energy (WtE) is one of the leading technologies for mixed municipal solid waste (MSW) treatment in Europe. WtE plants treat in Europe nearly 80 million tonnes of MSW per year and produce approximately 20 million tonnes of incineration bottom ash (IBA). The recovery of ferrous and non-ferrous metals from larger particles over 2-4 mm is common practice in many European countries. However,30-40 % of IBA are particles below 2 mm often called the fine fraction, their annual European production is 6-8 mil. tonnes. The IBA fine fraction contains a significant amount of non-ferrous metals (1-2 % of Al, up to 1 % of Cu, and a small amount of other heavy non-ferrousmetals consisting of precious metals, rare earth elements, etc.). Metals recovery from the IBA fine fraction is up to now very rare and it represents a wasted potential of about 70,000-140,000 t Al and up to 70,000 t Cu per year. Moreover, the IBA fine fraction cannot be used in the construction industry, except for road construction together with coarse fractions, because environmental quality does not meet the legal requirements mostly due to the elevated metal content and their leachability. The ReFina project is focused on the development of innovative methods for efficient treatment of the IBA fine fraction with respect to metals, particularly heavy non-ferrous metals, and minerals recovery. Various physical separation methods will be used as well as hydro-metallurgical processes for the exploitation of metals and metalloids, which is an innovative approach for complex treatment of IBA particles below 2 mm. The metal depleted mineral residue will be used as in the construction industry, particularly in autoclave aerated concrete. Hence, the Refina project will contribute to the increasing rate of recycling and secondary raw materials utilization, mainly with respect to metal and mineral recovery.		
Participating organisations	1. Coordinator: Czech Academy of Sciences (Czech Republic) 2. Pražské služby, a.s. (Czech Republic) 3. LEPMI (CNRS Délégation Alpes) (France) 4. VITO NV (Vlaamse Instelling voor Technologisch Onderzoek) (Belgium) 5. INSA Lyon (France) 6. Indaver (Belgium)		
Project duration	36 Months (10/2020 to 09/2023)		
Total Costs	€2,365,394	**Total Requested Funding**	€1,179,793

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REVIVING

Project acronym	**REVIVING**		
Project title	REVIVING – revisiting mine tailings to innovate metals bio recovery		
Main topic	3. Processing, Production and Remanufacturing		
Sub-topics	3.1 Increase resource efficiency in resource intensive production processes; 3.2 Increase resource efficiency through recycling of residues ore manufacturing of used products and components; 5.2 Improvement of methods or data for environmental impact assessment; 5.3 Social acceptance and trust/public perception of raw materials.		
Keywords	Bioleaching, Omics techniques, microbiome manipulation, Biohydrology, recovery model		
Publishable abstract	This project is focused on valuing mine tailings as resources, supplying metals that are extracted today via other processes, promoting recycling, minimizing the production of hazardous waste and thereby embracing a circular economy. The project uses knowledge obtained in the ERAMIN project BioCriticalMetals (ERAMIN/0002/2015) on the microbiome of tailings. The objective of the REVIVING project is to get improved models for efficiently recycling metals from residues in case-study mines. For the first time, this is based on autochthonous tailings microbiome manipulation to promote the bioleaching-bacterial populations and innovative hydrometallurgy. The project covers the entire cycle of obtaining metals, from secondary sources to a product to sell. At the same time, by enabling true tailings recycling and reduction of residues produced by mining, we reconnect raw materials to the society. In perspective, the tailings basins could be used as a productive system for the provision of marketable metals. The expected success of this work will result in the validation of a clean, economic and innovative bioprocess for metal recovery from wastes, which will return residues to the productive cycle, supporting the EU's transition to a circular economy. The project will consist of several work steps, starting with small-scale assays performed in columns to test the potential of the manipulation of the tailings microbiome in leaching of Cu, Mn, Zn, Mo (non-critical major elements), W and Mg (critical metals) from tailings from Portuguese (Beralt Tin & Wolfram, Panasqueira) and Romanian (CUPRUMIN S.A. Abrud, CNCAF Minvest Deva)mines. REVIVING will innovate the bioleaching process enabling zero mine waste. The generated knowledge will push the EU to the front of the raw materials processing technologies and solutions. By recycling mine residues, soil areas will be returned to agriculture, forestry, and population, increasing mine social acceptance.		
Participating organisations	1. Coordinator: University of Coimbra (Portugal) 2. National Institute of Research and Development for Biological Sciences (Romania) 3. Beralt Tin and Wolfram (Portugal) 4. ACPMR-ASSOCIAÇÃO CLUSTER PORTUGAL MINERAL RESOURCES (Portugal) 5. Universite Grenoble Alpes (France) 6. CUPRUMIN S.A (Romania) 7. C.N.C.A.F. MINVEST SA DEVA (Romania) 8. DKM Control Limitada (Portugal)		
Project duration	36 Months (01/2021 to 12/2023)		
Total Costs	€1,151,588	**Total Requested Funding**	€707,002

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REEScue

Project acronym	**REEScue**		
Project title	Integrated process for the recovery of Rare Earth Elements and Scandium from Bauxite Residues		
Main topic	3. Processing, Production and Remanufacturing		
Sub-topics	3.2 Increase resource efficiency through recycling of residues or remanufacturing of used products and components		
Keywords	Rare Earth Elements, Critical Metals, Bauxite Residues, Secondary raw material		
Publishable abstract	Bauxite residue (BR) is a highly alkaline and very fine-grained by-product of the Bayer process. Its huge global annual production, ~150million tonnes, has resulted in BR increasing accumulation, causing deposition problems and environmental problems. The valorisation of Bras a low cost secondary raw material and metal resource, could be a route for its reduction, introducing the waste again in the economic cycle. BR is rich in minerals and metals of high economical interest. A typical BR material contains up to 1400 ppm Total Rare Earth Oxides (TREO), corresponding to about 1000 ppm in Total Rare Earths (TREE). Particularly important is BR content in REE and CRMs including Nd (110 ppm), La (150 ppm), Y (120 ppm), Ds (20 ppm). Additionally, ERA-MIN2REEScue - ID: 823 of 9BR is rich in scandium (Sc). BR contains ~120 ppm Sc per tonne of dry BR. In Europe, alumina industries utilise about 12 million tonnes of bauxite to produce about 7 million tons of alumina. The current BR production in the EU is 6.8 million tonnes per year and it is estimated that the cumulative BR stockpile is more than 250 million tonnes. The main aim of the proposed project is the efficient exploitation of European bauxite residues, containing appreciable concentrations of scandium and REEs, through the development of innovative extraction and separation technologies. It is estimated that the potential quantity of the extracted metals from the annual BR production only from 3 plants (AoG, ETI, VIMETCO) is1385 t/y TREO. This represents 14.6% of the EU needs in TREOs. The overall target is to develop a stable and secure EU CRM supply chain to serve the needs of EU high tech industry. The project concept and the proposed technical solutions are based on the smart combination of physical and hydrometallurgical processes that will enable the recovery of Sc and REEs from BR, the production of other valued marketable products and the drastic reduction of the quantity of BR to be disposed.		
Participating organisations	1. Coordinator: National Technical University of Athens (Greece) 2. Mytilineos SA (Greece) 3. Necmettin Erbakan Üniversitesi (Turkey) 4. VIMETCO ALUM (Romania) 5. ETI Aluminyum A.S. (Turkey)		
Project duration	30 Months (10/2020 to 03/2023)		
Total Costs	€624,798	**Total Requested Funding**	€510,046

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TOPIC 4 - RECYCLING AND RE-USE OF END-OF-LIFE PRODUCTS

Baclem

Project acronym	**BaCLEM**		
Project title	Bio-assisted Closed loop recycling of E-Mobility Metals from waste PCBs and Li-Ion Batteries		
Main topic	4. Recycling and Re-use of End-of-Life products		
Sub-topics	4.2 End-of-life products pre-processing: pre-treatment, dismantling, sorting, characterisation; 4.3 Recovery of raw materials from End-of-life products.		
Keywords	Bio-hydrometallurgy, E-waste, Recycling, Circular Economy, E-Mobility Metals		
Publishable abstract	BaCLEM aims to introduce technological solution to increase the recycling efficiency of low-grade printed circuit boards (PCBs) & spent Li-ion batteries. The bio-based approach employs a purposely developed robust bacterial consortium (acidophilic & heterotrophic micro-organisms) able to work at high pulp-densities & sustain high metal tolerances during leaching. These micro-organisms will be made available through combination between genetically engineered construction & design and use of "bacteriocins- approach", which will provide an innovative break-through in bio-hydrometallurgical research per se. The e-waste feedstock (low-grade PCB's and spent LIBs) will be purposely preconditioned as to guarantee efficient metals solubilisation under industrially relevant constraints. The entirely bio-based flow-sheet envisaged will ultimately enable selective recovery of E-mobility metals (Cu, Co, Ni, Li, Mn, Au & Ag) with their subsequent concentration into enriched fractions which have commercial value (metal carbonates, metal sulphides and nano-powders). On scientific side, BaCLEM delivers a solution that will exactly bridge the gaps between the notorious heterogeneity of e-waste materials, the complexity and diversity of bio-assisted metal-solubilising technologies and the lack of data on operational mechanisms on biological metal resistivity. On a regional level, results from BaCLEM will be demonstrated at semi-pilot scale through the industrial partner participating in the project as to showcase economic and environmental viability towards potential stakeholders. Therefore, the BaCLEM project aims to develop an ambitious and highly innovative technology for the recovery of E-mobility metals. This project will fill the technology gap where no technologies exist. This project will help in improving EU competitiveness in resource recovery and recycling of PCBs and spent Li-ion batteries. Further, this project supports the circular economy by converting waste to value.		
Participating organisations	1. Coordinator: Suleyman Demirep University (Turkey)) 2. Université de Liège (Belgium) 3. Institut de Physique du Globe de Paris (France) 4. EXITCOM RECYCLING (Turkey) *5.* SYNGULON (Belgium)		
Project duration	36 Months (11/2020 to 10/2023)		
Total Costs	€866,406	**Total Requested Funding**	€807,793

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SMART-G

Project acronym	**SMART-G**		
Project title	Smart Geopolymers		
Main topic	4. Recycling and Re-use of End-of-Life products		
Sub-topics	3.2 Increase resource efficiency through recycling of residues or remanufacturing of used products and components.		
Keywords	bauxite residue, biomass ash, fire resistant geopolymer, insulating material, air cleaning surface		
Publishable abstract	The project aims at the development, production, and demonstration of light weight, fire resistant components for the construction industry. Industrial residues will be valorised and via geopolymerization turned into fire resistant materials. The waste envisioned is 'bauxite residue (or red mud)', bricks and tiles from construction and demolishing waste, and fly ash from biomass incineration. Today, these wastes are orlandfilled, or downcycled. In this project, the different waste streams will be combined in the right proportions, after physico-chemical pre-treatment. This mixture is then molten and quenched as a kind of slag. The result is a good precursor for geopolymers (or alkali activated cements). The blending ensures the constant composition and quality of the precursor. As such a new value chain/business model will be developed for the demolishing/construction business. For a successful continuation after the project, this value chain will be studied in detail. To allow the production of complex shapes, a fire-resistant paste for 3D printing of objects will be developed. The final application envisaged in this project will be insulating panels. The panels can be used as non-flammable insulating material for buildings or for concrete protection in tunnels. The technology is currently at a TRL of 4 and will be raised towards 8. As the slag produced has a very constant quality, it will also be a valuable precursor for other high-end applications, like a dry repair concrete or for the matrix of textile reinforced cements. A novel high Light Reflectance Value (LRV) photocatalytic paint will be applied as a surface coating on the fire-resistant component to enhance the fire safety and to act as air cleaning agent (oxidizing pollutants). The photocatalytic paint can also work in a tunnel, where the panels could be used to protect the concrete structure. A demonstration about the fire resistance will be performed on real scale.		
Participating organisations	1. Coordinator: Vrije Universiteit Brussel (Belgium) 2. University of Aveiro (Portugal) 3. MNLT Innovations GP (Greece) 4. Cracow University of Technology (Poland) 5. Przedsiębiorstwo Budowlano-Produkcyjne Łęgprzem Sp. z o.o (Poland) 6. IESL/FORTH (Greece) 7. ResourceFull (Belgium) 8. Mytilineos S.A. (Greece)		
Project duration	24 Months (10/2020 to 09/2022)		
Total Costs	€1,085,926	**Total Requested Funding**	€899,139

Co-funded by the Horizon 2020 programme of the European Union

ANTISOLVO

Project acronym	**ANTISOLVO**		
Project title	Antisolvent precipitation to extract the value from end-of-life Nd-Fe-B magnets		
Main topic	4. Recycling and Re-use of End-of-Life products		
Sub-topics	4.3 Recovery of raw materials from End-of-life products; 5.3 Social acceptance and trust/public perception of raw materials		
Keywords	neodymium, magnet, recycling, antisolvent, ion exchange		
Publishable abstract	Recently Europe has set ambitious climate targets, as embedded in "The European Green Deal" (EC, COM (2019) 640). To drive this transition to a climate-neutral economy, Europe will need a sustainable and secure supply of a host of key technology metals, which are essential for large-scale renewable energy production and storage as well as the electrification of mobility. However, key metals such as rare earths and cobalt have been classified by the EC as "critical raw materials" (CRMs). To overcome Europe's dependency on CRMs, urban mining and recycling have been put forward as one key strategy next to primary mining and CRM substitution. The primary objective of the ANTISOLVOERA-MIN2 project is to take a new concept, antisolvent precipitation, and apply it to the indirect, chemical recycling of End-of-Life rare-earth-based permanent magnets that are contained in both electric vehicles, direct-drive wind turbines and a multitude of consumer electronics(incl. smart phones and laptops). The envisioned ANTISOLVO recycling flowsheet intends to selectively separate the rare earths (REEs) from a Nd-Fe-B magnet leach liquor (WP2), which will also contain iron, cobalt and other metals. The latter are recovered in a second step using ion exchange and extraction chromatography (WP3). The required organic antisolvent is recycled and fed back to the antisolvent precipitation unit operation. To understand and maximize the effectiveness of antisolvent precipitation for REEs and to support the overall flowsheet development, WP4 smartly integrates advanced characterization techniques, incl. extended X-ray absorption fine-structure (EXAFS)spectroscopy and transmission electron microscopy. As a secondary objective ANTISOLVO targets new ways to engage with the general public through the medium of "circular economy video clips" to change attitudes to End-of-Life devices such as smart phones or laptops (WP5-6).		
Participating organisations	1. Coordinator: KU Leuven (Belgium) 2. KTH Royal Institute of Technology (Sweden) 3. Jožef Stefan Institute (Slovenia)		
Project duration	36 Months (01/2021 to 12/2023)		
Total Costs	€660,000	**Total Requested Funding**	€660,000

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TOPIC 5 - CROSS-CUTTING TOPICS

ELiMINATE

Project acronym	**ELiMINATE**		
Project title	End-of-life Li-ion battery management integration and technology evaluation		
Main topic	5. Cross-Cutting Topics		
Sub-topics	4.3 Recovery of raw materials from End-of-life products; 5.1 New business models; 5.2 Improvement of methods or data for environmental impact assessment.		
Keywords	business model, hydrometallurgy, life cycle assessment, lithium-ion batteries, material flow analysis		
Publishable abstract	Hydrometallurgical processes will play an increasingly important role in processing of end-of-life (EoL) lithium ion batteries (LIBs) given its potential advantages compared to pyrometallurgical processes and the expected increase in generation of EoL LIBs with the growth of electric vehicle fleets. Although there are examples of commercial hydrometallurgical EoL LIBs processing facilities, increasingly stringent environmental legislation and requirements for more efficient processing require rigorous evaluation of alternative hydrometallurgical processes. The objective of ELiMINATE is to evaluate different alternative hydrometallurgical processes relying on a combination of alternative leaching reagents, alternative pre-treatment steps combined with hydrometallurgy, and/or novel solution purification technologies. The suite of processes to be evaluated will consist of existing technologies for which process performance data are available, as well as two novel technologies for which processing data will be generated as part of this project. The evaluation of the technologies will be done through: 1)market analyses and business case development to understand appropriate value chain integration strategies for different technologies; 2)life cycle assessment to compare the environmental impact of different technologies and to identify requirements for further technical development/improvement; and 3) material flow analyses and reverse logistics optimisation to improve resource efficiency of the lithium-ion battery recycling industry. The project will deliver an implementation framework to advise on the best way forward in terms of establishing local end-of-life lithium-ion battery treatment facilities. It is anticipated that the outcome of the project will allow improved handling and management of EoL LIBs, reducing the environmental impact associated with the transport and disposal of EoL LIBs, as well as allowing for the local valorisation of LIBs.		
Participating organisations	1. Coordinator: Stellenbosch University (South Africa) 2. IVL Swedish Environmental Research Institute (Sweden) 3. Karadeniz Technical University (KTU) (Turkey) 4. Chalmers University of Technology (Sweden) 5. Exitcom Recycling electronic recycling and battery recycling (Turkey)		
Project duration	36 Months (12/2020 to 11/ 2023)		
Total Costs	€668,136	**Total Requested Funding**	€647,896

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PROPER

Project acronym	**PROPER**		
Project title	New sustainability metrics to improve recycling PROcess PERformances regarding resource use, environmental impacts and economic benefits		
Main topic	5. Cross-Cutting Topics		
Sub-topics	5.1 New business models; 5.2 Improvement of methods or data for environmental impact assessment.		
Keywords	Resource productivity, resource dissipation, recovery processes, circular economy, life cycle assessment		
Publishable abstract	The exploitation of natural resources generates economic development but compromises the associated natural capital and produces environmental impacts. The European Commission considers the decoupling between economic growth and resource use as the central core of strategies on eco-efficiency of resources. List of resource efficiency indicators measuring this decoupling exists but suffers from some criticisms. The goal of PROPER is to develop resource efficiency indicators to be applied in the private sector to take better decisions, for both investment and commercialization, in the context of primary and secondary production. This development relies on life cycle approaches to address the overall loop closing evaluation in a circular economy perspective. Furthermore, such indicators are tools to measure the sustainability performances of materials production. To reach this objective, PROPER aims at developing indicators and testing their applicability in a process perspective by studying three substances (silicon carbide, chromium oxide and graphite) and their primary and secondary productions The project firstly develops a methodology to operationalize the quantification of resource dissipation. Then dissipation is integrated to the LCA of the three substances and the two production routes to quantify the associated potential		
Participating organisations	1. Coordinator: BRGM (France) 2. RDC Environment (Belgium) 3. Extracthive Ceramics Recycling (France)		
Project duration	36 Months (12/2020 to 11/2023)		
Total Costs	€442,844	**Total Requested Funding**	€250,835

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