6 June 2025 | online webinar

#EU GREEN WEEK

EU Green Week Partner Event

PEACOC Project

Valorising European End-of-Life resources for Precious Metals recovery

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TECNALIA

tecnalia
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

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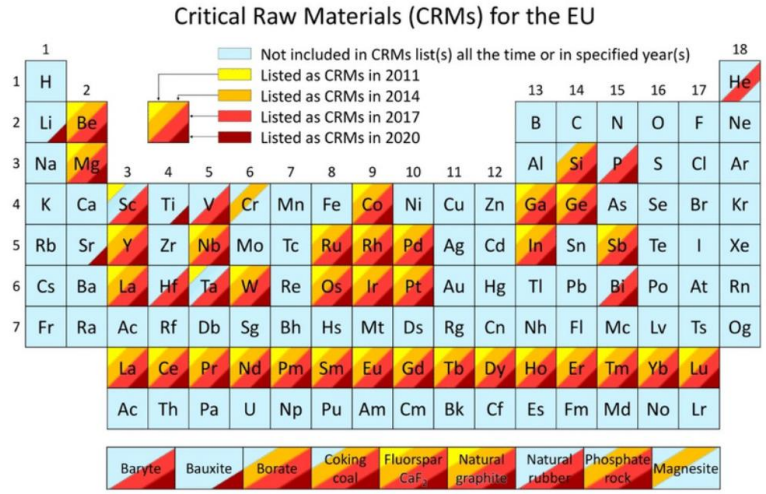
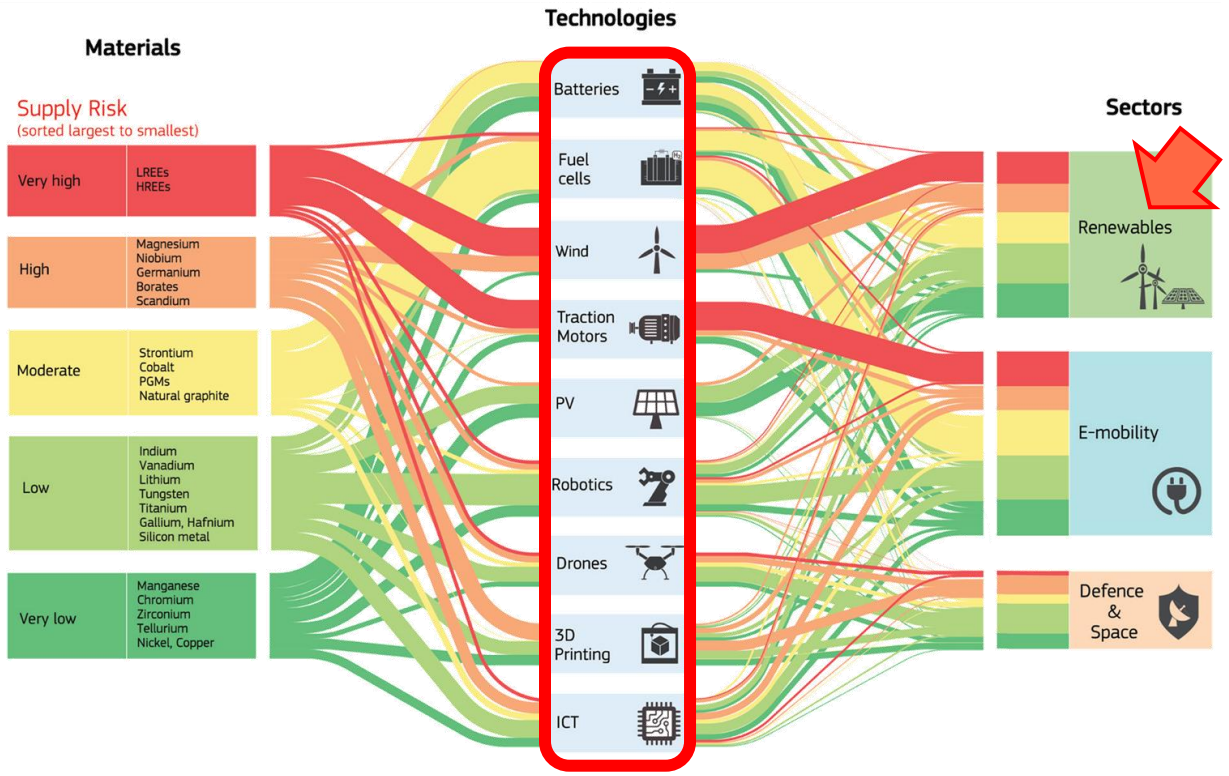
The PEACOC Project – Content of the Presentation

1. **Introduction** – The challenges of the recyclability of Precious Metals and Critical Raw Metals
2. **PEACOC Project overview** – Our partners, technologies, processes
3. **Latest achievements** – Our latest results
4. **Next steps**

INTRODUCTION – Critical Raw Materials

European list of CRM*





→ Critical for industrial development

→ Critical for environment

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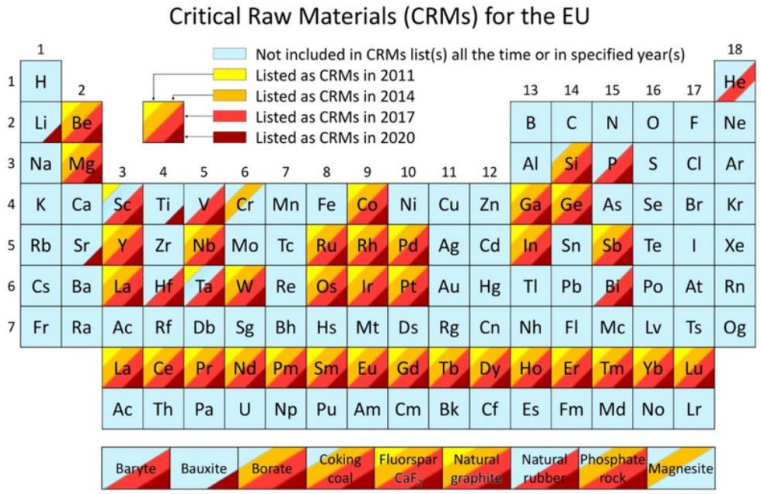
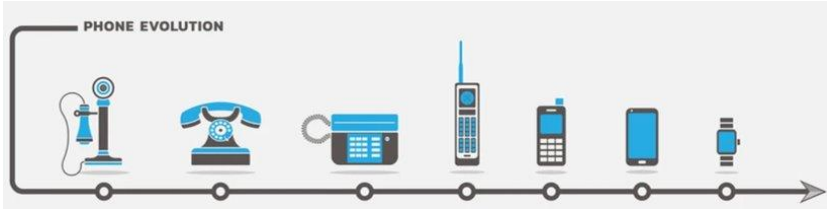
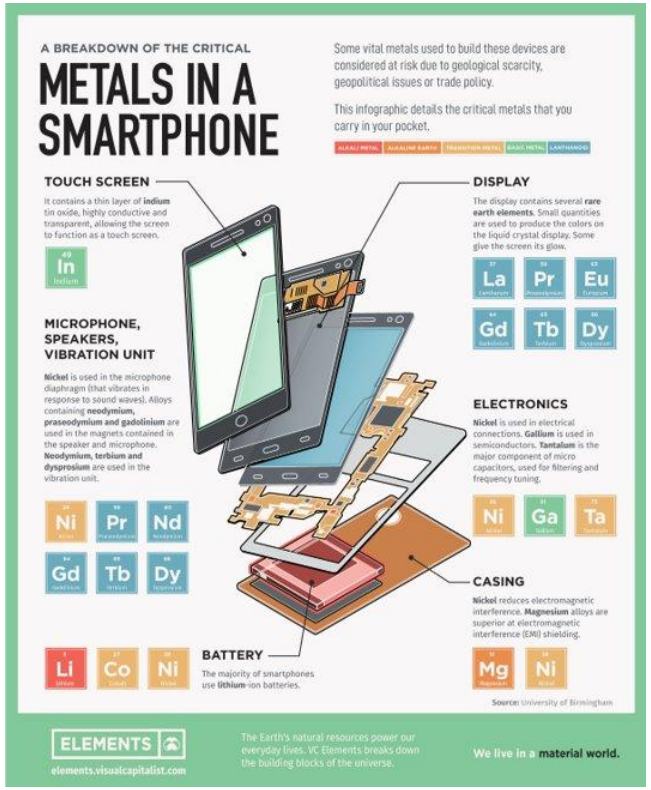
*https://ec.europa.eu/growth/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en

INTRODUCTION – Critical Raw Materials

European list of CRM*







→ Critical for industrial development

→ Critical for environment

→ Critical for technological development

→ European dependency in external import

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*https://ec.europa.eu/growth/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en

INTRODUCTION – Recyclability of CRM

The **current industrial recycling technologies** such as smelting or hydrometallurgical processes **present several limitations**

- CAPEX-OPEX intensive (i.e., high energy demand, high temperatures)
- Complexity of feedstock

- High environmental footprint (i.e., high CO2 emmissions, strong acidic solutions, etc)

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INTRODUCTION – What do we do in Europe

European Institute of Innovation and Technology in RM

eit RawMaterials
Connecting matters

Horizon Europe (2027)

HORIZON EUROPE

European Raw Materials Allianze (ERMA)

EUROPEAN RAW MATERIALS ALLIANCE | ERMA

WEEE Directive Batteries Regulation

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PEACOC PROJECT OVERVIEW

SPENT AUTOCATALYSTS

WEEE/PCBAs

EoL PV PANELS

CONCENTRATION → REFINING → VALORIZATION

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OBJECTIVE: To recover CRM and precious metals **(Pt, Pd, Rh, Au and Ag)** from spent autocatalysts, PCBAs and PV scrap and to valorise them into new products

Grant agreement N: 958302

Coordinator: FUNDACIÓN TECNALIA RESEARCH & INNOVATION, Spain

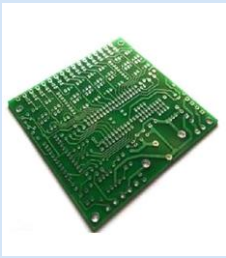
Consortium: 18 Partners from 9 countries

Duration: 1 May 2021 – 31 Jan 2026

New autocatalysts

3D printing

Jewelry



Electrical components printing

Individual streams

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PEACOC PROJECT OBJECTIVES

To demonstrate a first-of-a-kind economically and environmentally-viable pre-commercial metallurgical system for recovering precious metals from a wide variety of abundant *EoL* products in Europe

i) **2 kg PGMs/week** from spent **autocatalysts**

ii) **0.5-1 kg Au/week** from Printed Circuit Board Assembly (PCBA) with a focus on **low and medium grade PCBA**

iii) **10 kg Ag/week** from **EoL Photovoltaic (PV) panels**

Design and operate a **mobile refining pilot** at pre-commercial scale for producing precious metals from EoL products

Improve the **precious metals concentration** stage by up to 100 times

Valorise PMs recovered into new marketeable applications

Prove the **PEACOC sustainability** from economic, technical and environmental perspectives

Expand the impact of the PEACOC project by **exploring untapped EoL products** containing PMs in **Europe** and **neighbouring countries**

Aim at near **zero-waste strategy** by valorizing the residues into new functional products

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PEACOC PROJECT OVERVIEW

Pre-treatment and concentration

EoL Autocatalysts

MONOLITHOS CATALYSTS - RECYCLING - INNOVATION

Low/medium-grade EoL PCBA

NOVA LIÈGE université

Roller sorting TUDelft

MDS TUDelft

EoL PV panels

comet traitements

Magnetic sorting TUDelft

GOLD REC UNIVERSITÀ DEGLI STUDI DE L'AQUILA

Refining – PEACOC pilot plant

Microwave-Assisted Leaching

vito

ceinnmat Emerging technologies

Gas-diffusion Electrocrystallization

vito

6TMIC Manufacturing solution using advanced engineering

JM

Precious metals

Residues

Valorization

Mechanical Alloying

MBN nanomaterialia

Powder composites

Extrusion

3D HUB GREECE

Filaments for 3D printing

3D printing

3D-printed items: jewelry, catalysts and PCBs

Manufacture of autocatalysts and fuel cells

CRF CENTRO RICERCHE FIAT

Ford FORD OTOSAN

MONOLITHOS CATALYSTS - RECYCLING - INNOVATION

vito

Autocatalysts and Hydrogen fuel cells

Deep Eutectic Solvent

tecnalia

Single Precious Metals

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PEACOC PROJECT – LATEST ACHIEVEMENTS

1. Upscaled processes under concentration routes

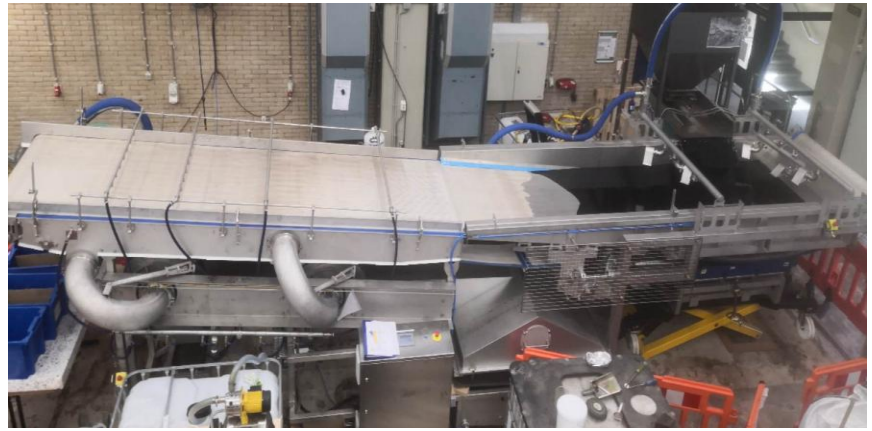
NOVA process (University of Liege)

150 kg of PCBAs per batch

Roller sorting (TUDelft)

25 kg/h

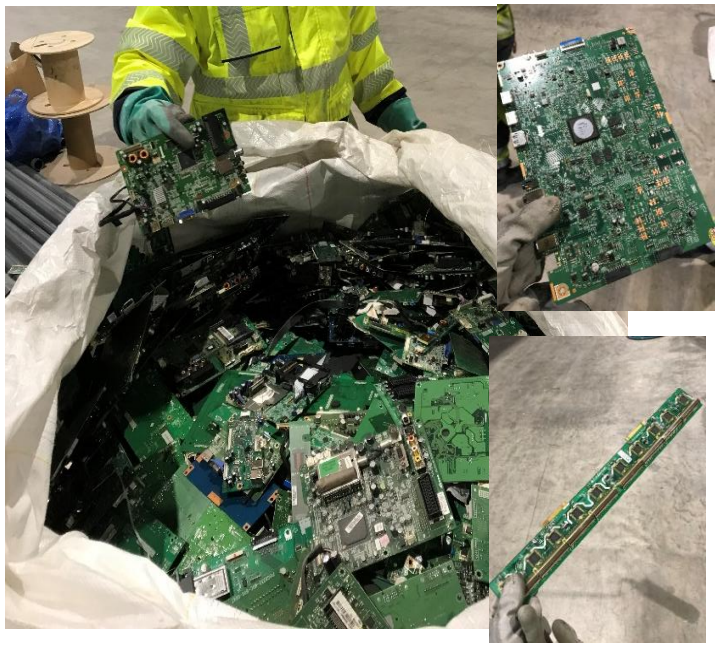
MDS process (TUDelft)



1,000 kg/h

PEACOC PROJECT – LATEST ACHIEVEMENTS

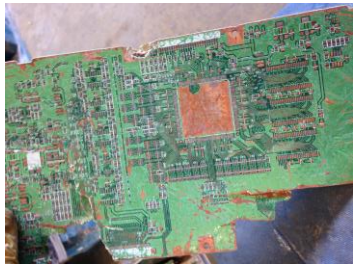
2. PMs concentration from mid-grade PCBAs at large scale



PMs (Ag, Au, Pd)
~ 600 ppms

NOVA + BIOLIX
LIÈGE université

Roller sorting + MDS
TU Delft

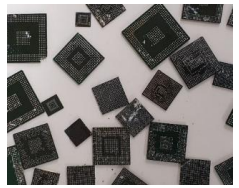


Depopulated PBCAs

Concentrates (Sn, Cu)

PMs (Ag, Au, Pd)
~ 9500 ppms

Electronic components



CPUs

IC chips

MLCC

PMs (Ag, Au, Pd)
~ 1500 – 10,000 ppms

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PEACOC PROJECT – LATEST ACHIEVEMENTS

3. PMs concentration from PV scrap at large scale

PMs (Ag)
~ 1.4%

Sieving + Density separation + Magnetic sorting

TU Delft

PMs (Ag)
~ 4.8%

PMs (Ag)
~ 5.4%

GOLD REC

Removal of Fe and Cu content

PEACOC PROJECT – LATEST ACHIEVEMENTS

4. MWAL and filtration units installed and operating at pilot scale

MONOLITHOS
CATALYSTS - RECYCLING - INNOVATION

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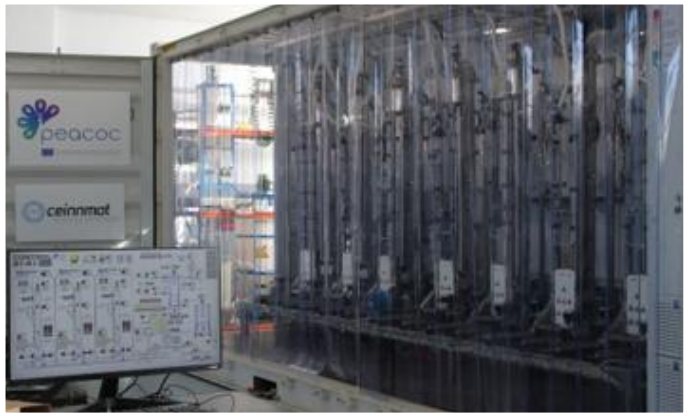
Emerging technologies



6TMIC
Manufacturing solution using advanced engineering

PEACOC PROJECT – LATEST ACHIEVEMENTS

5. First processing of autocatalys successfully completed

Spent TWC

Leachate solution Pt, Pd, Rh

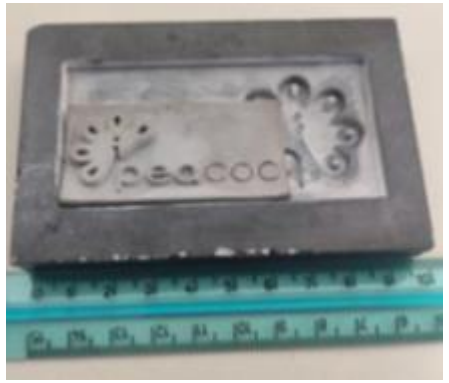
- ✓ Installation of periferals (tanks, leaking trays, feeding systems, etc).
- ✓ Installation and successfull testing of the automatization system.
- ✓ Ventilation installed.
- ✓ Controller platform operative.
- ✓ First testing carried out in blank conditions.
- ✓ First processing of real stream was carried out.
- ✓ Preliminary validation of mass balances tool for pilot testing.

PEACOC PROJECT – LATEST ACHIEVEMENTS

6. New automotive catalyst from recycled PGMs

MONOLITHOS has successfully produced it and demonstrated the same conversion performance than commercial ones.

7. Alternative process to make feedstock power for additive manufacturing



MBN has demonstrated this new process using residual matrices from the PEACOC process.

PEACOC PROJECT – LATEST ACHIEVEMENTS

8. Concentration and separation of PMGs from spent autocatalysts

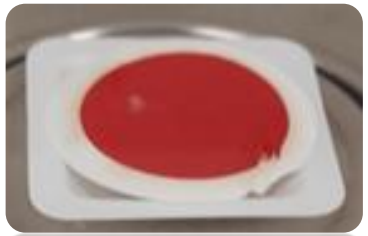
Milled spent autocatalyst

Rh ~ 0.03%
Pd ~ 0.2%
Pt ~ 0.1%

Solid sample (mixture of PGMs)

Rh ~ 1%
Pd ~ 73%
Pt ~ 26%

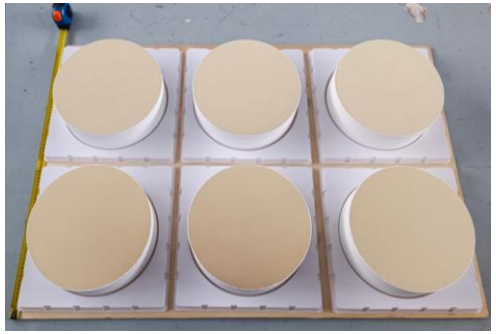
Rh ~ 0.64%
Pd ~ 91%
Pt ~ 8.3%



Rh ~ 0.52%
Pd ~ 12.7%
Pt ~ 86.3%

TECNALIA has developed a process for the selective recovery of PGMs from spent autocatalysts and its separation and has validated the process with different PGMs streams.

PEACOC PROJECT – NEXT STEPS



- ✓ VITO GDEx unit to be installed at MONOLITHOS FACILITIES and assembling of the whole PEACOC process.
- ✓ Testing a demonstration of the PEACOC pilot using autocatalyst, PCBAs and PV streams.
- ✓ Valorization of obtained PMs into different applications.
- ✓ Complete Mass Balances and finalise validation of the MB tool.
- ✓ LCA, LCC and benchmarking analysis.
- ✓ Exploitation and Business Plan.
- ✓ Dissemination activities.
- ✓ Etc…

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The PEACOC Project

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