



## Selective recovery of PGMs from spent autocatalyst using DESs

TECNALIA

CARE INNOVATION 2023

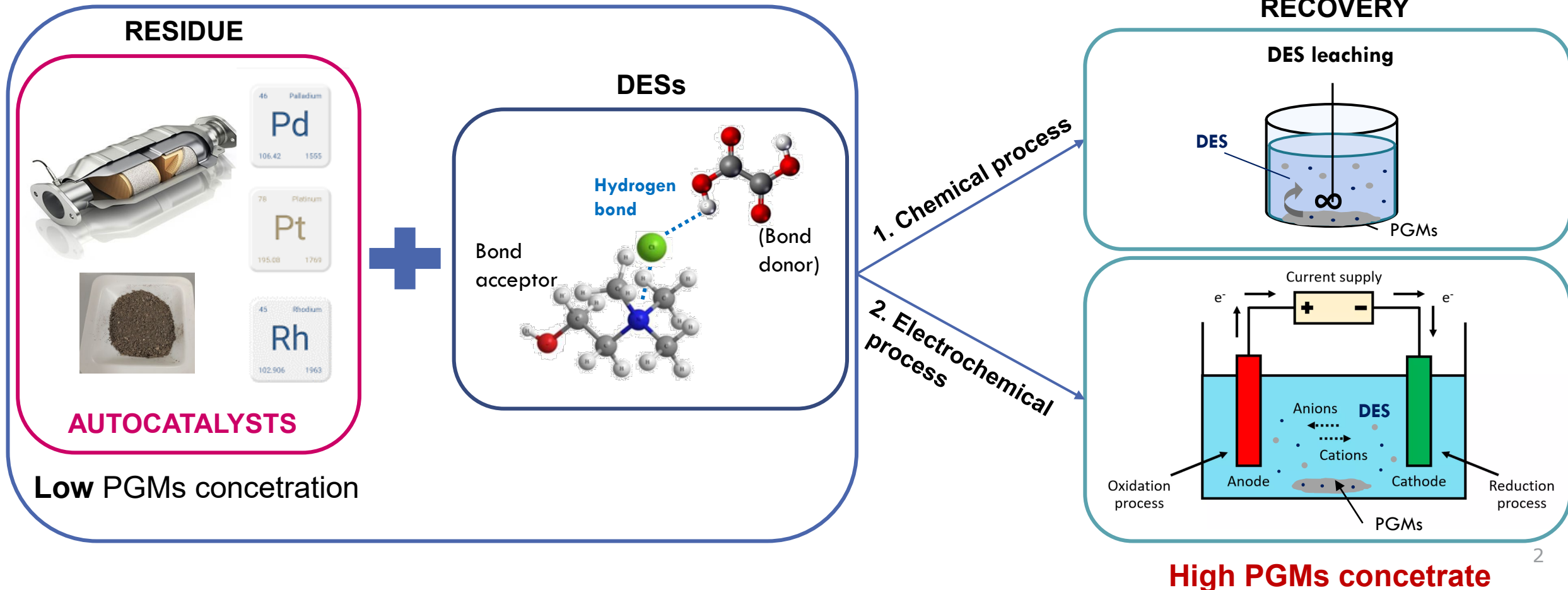
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The project has received funding from the European Union's Horizon 2020 research and innovation program under Grant Agreement N° 958302

# Objective

- Current global **demand for PGMs** is driven by their use in **autocatalysts**.
- **Europe is the world's largest consumer of PGMs. Mainly used for autocatalysts production** (~ 90%, 54% and 80% of Pd, Pt and Rh, respectively, were consumed by autocatalysts in 2019, ~155 t\*).
- **The primary production of PGMs in the EU is insignificant** (~85% of the primary supply comes from South Africa and Russia\*).

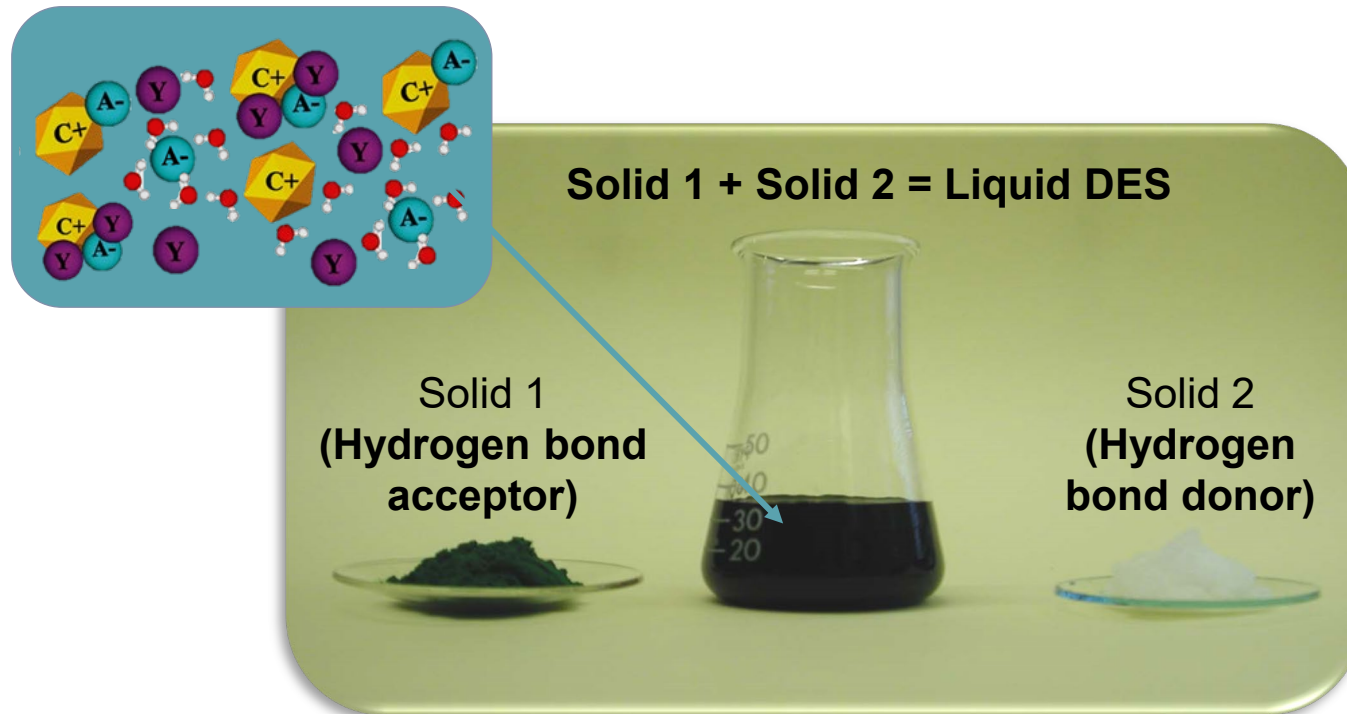


# The use of deep eutectic solvents (DES) for metal recovery

## DEEP EUTECTIC SOLVENT (DES)

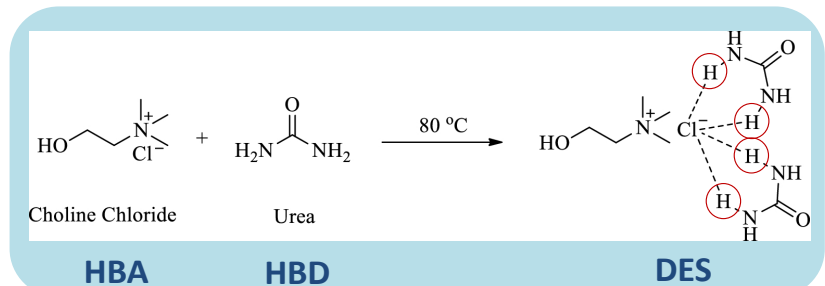
Systems formed from a eutectic mixture of Lewis or Brønsted acids and bases. They are classified as types of ionic solvents with special properties: eutectic with a melting point much lower than either of the individual components.

Deep Eutectic Solvents (DES) are formed from a eutectic mixture of two components, one hydrogen bond donor (HBD) and one hydrogen bond acceptor (HBA).



## Most relevant properties

- Easy preparation
- Low cost precursors
- Biodegradable
- Recyclable
- Non- flammable
- Excellent solvent & reaction media
- Can be selective solvents

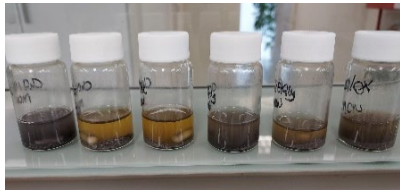




# Selective recovery of PGMs from spent autocatalyst using deep eutectic solvents (DES)

- This innovation allows the **selective recovery of PGMs from solid residues of spent catalyst as a precipitate of PGMs mixture (95% purity)**, containing 67% of Pd and 27 % of Pt and 1% Rh.
- In addition, we have also studied the **reuse of DES during seven cycles**, and the results do not show a significant decrease in the extraction yield of PGMs.

## DES screening



Selected  
DES

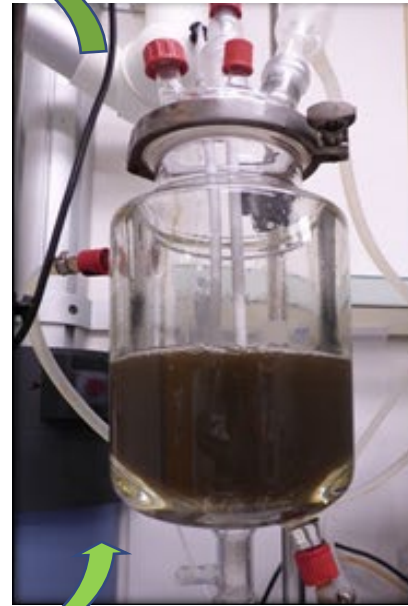
Spent catalyst  
after ULIEGE  
flotation  
process  
Pd: 0.4 %  
Pt: 0.2 %  
Rh: 0.07 %

## DES recycling



DES Leaching  
extraction

(Pd: 90%, Pt; 78%; Rh:42%)



Reduction

Patent  
submitted

Concentrated PGMs  
mixture (95%)



TECNALIA's  
product  
Pd: 67 %  
Pt: 27 %  
Rh: 1 %

## Advantages

Selective recovery of  
PGMs

Benign chemicals

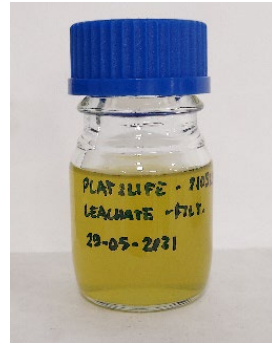
Reuse of reagents

Maximize mass,  
energy, space and  
time efficiency

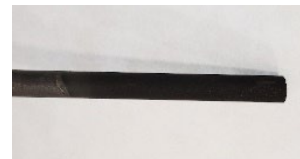
# Electrorecovery of PGMs directly from spent-catalyst solid residues

This innovation allows the electrification of the leaching process to **selective recover PGMs from solid residues (82% purity) in a single reactor without adding  $H_2O_2$** .

Spent catalyst after ULIEGE flotation process  
Pd: 0.4 %  
Pt: 0.2 %  
Rh: 0.07 %



Leachate



Graphite (deposited PGMs)



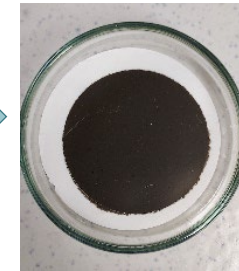
Initial



Final

Patent submitted

Concentrated PGMs mixture (82%)



TECNALIA's product  
Pd: 70 %  
Pt: 8 %  
Rh: 4 %  
Pb: 18 %

**ELECTROLEACHING (ELX)**  
DES (80%) + seawater (20%)  
+ HCl (as additive)  
(45 mA/cm<sup>2</sup>; t=3 h; WE=BDD)

**SWITCH POLARIZATION**  
Seawater (1 V; ≈ 5 min;  
WE=graphite)

Selective recovery of PGMs

Benign chemicals

Electrify the leaching process to avoid adding oxidizing agents

Maximize mass, energy, space and time efficiency

Advantages





Thank you

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