CONSORTIUM

SINTEF

tecnalia Inspiring Business

LCM less common metals

VAC VACUUMSCHMELZE

Elkem A Bluestar Company

idener

Ai3 INOVERTIS

liten cea tech

STENA

AVERE The European Association for Electromobility

SNAM Florigenne

PNO

cefic

Université Toulouse III Paul Sabatier

CONTACT US

If you would like more information about the project, please contact us:

Project Coordinator:

Dr. Ana Maria Martinez

SINTEF Materials and Chemistry

AnaMaria.Martinez@sintef.no

Exploitation manager:

Dr. Nader Akil

PNO Innovation (PNO Innovation B.V.)

nader.akil@pnoconsultants.com

Dissemination contact:

Dr. Patrizia Circelli

Ciaotech (PNO Innovation B.V.)

p.circelli@ciaotech.com

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REE4EU

SPIRE Sustainable Process Industry through Resource and Energy Efficiency

REE4EU PROJECT

RARE EARTH RECYCLING FOR EUROPE

Integrated high temperature electrolysis and Ion liquid extraction for a strong and independent european rare earth elements supply chain.

www.ree4eu.eu

THE PROJECT

The project, funded in the frame of Horizon 2020 TOPIC SPIRE-07-2015, will realize a breakthrough innovation in the field of recovery technologies for metals and other minerals. It will make available rare earth elements and rare earth alloys for magnet production by developing, for the first time at industrial scale, an efficient and cost effective method of extraction and a direct production route for rare earth alloys which will be achieved through in-process and end-of-Life permanent magnets as well as Ni metal hydride battery waste.

OBJECTIVES

The REE4EU project will develop, validate and demonstrate in 2 industrially relevant pilots an innovative rare earth alloys production route from permanent magnets and nickel metal hydride battery waste.

The targeted integrated solution is based on recently developed lab-proven technologies for direct high temperature electrolysis of rare earth alloys production. It will be combined in the pilots with an innovative and proven Ionic liquid extraction or tailored hydrometallurgical pre-treatment.

BENEFITS

The targeted integrated solution will demonstrate dramatic improvements in cost and environmental performance compared to state of the art technologies:

- This includes avoidance of process steps,
- 50% energy savings,
- 100% recycling of reagents as opposed to disposal of strong acid leaching agents in state of the art pre-treatment steps.

THIRD YEAR PROJECT RESULTS

During the third year of the project, the consortium has finalised the engineering work related to the main pilot, which includes the basic and detail engineering of both the ionic liquid extraction (ILE) and high temperature electrolysis (HTE) units, with enough flexibility to be able to accommodate different RE-containing wastes. After the tender and purchasing phase of the equipment, the pilot was built up within dedicated facilities for REA production at Elkem site. The pilot tests using permanent magnet swarf, PMS (in-process waste from the permanent magnet production) were carried out successfully.

Moreover, fruitful pilot tests were carried out in the existing pilot unit at LCM using PMS-waste pre-treated by a pure hydrometallurgical method. The REA obtained has been used to manufacture new magnets, which showed the same properties as those obtained from virgin material.

In this way, the REE4EU project has demonstrated a closed-loop recycling scheme for permanent magnets at pilot scale, using RE-containing wastes available in Europe.

Furthermore, a market analysis has been carried out, where the prospective European market of secondary RE elements contained in selected End of Life products that have the potential to become viable feedstocks for RE recovery at industrial scale has been studied. The market analysis report is available at the project website.