Managing uncertainty in LCA of innovative rare earth elements recovery processes in REMAGHIC EU-project

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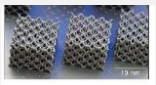
Task 5.1. Rare Earth Recovery Life Cycle Assessment

REMAGHIC Project objective:

Development of new technologies and improvement of existing ones:
Magnesium recycling + Rare earth elements (REE) recovery

Mg+REE alloy (for automotive, aeronautical, biomedical industries)





Poster objective:

Discussion on managing uncertainty in LCA of innovative REEs recovery processes:

- **No Life Cycle Inventories** (LCI) in the available LCA databases (ecoinvent and GaBi Professional) of some chemicals used
- **Extrapolation** of material and electricity consumption to higher TRL (Technology Readiness Level)

Materials & Method:

- Recovery of Yttrium, Cerium and Lanthanum
- Technologies:
  - Hydrometallurgical (Relight)
  - Pyrometallurgical (Tecnalia)
  - Ionometallurgical and solvometallurgical (KUL)
- Procedures:
  - Partners with higher TRL support those with lower TRL, (knowledge and experience) in extrapolating their process
  - Use of Software that optimizes process manufacturing (e.g. for chemical and energy, such as AspenTech) – ongoing activity
  - Unavailable LCIs created on literature research
  - Every decision regarding extrapolation/estimation of data was supported by partner experts

Objectives | Methodology | Results | Conclusions

- Processes developed in lower TRL (e.g. calcination step):
  - Electricity consumption was then extrapolated with support of partners working with higher TRL equipment and information gathered with machinery suppliers
- Production of oxalic acid, wollastonite (calcium silicate), calcium aluminate, and other chemicals:
  - LCI created on literature, preferably industrial processes
- Consideration of credits (i.e. reduction of environmental impact due to replacement of primary source by secondary one):
  - Literature research of hydrochloric acid (HCl) recycling process → higher CO_2 emission for HCl obtainment from secondary source

- **Reduction of uncertainties** around inputs with the approach used to create LCI of some of chemicals and electricity consumed
- Having managed these uncertainties in the first part of the project will allow the assessment of the up-scaling process of Mg+REE alloying ingots while still **assuring data quality**
- Consideration of credits in LCA modelling for chemicals that can be re-used / recycled - ongoing activity

- **Discussion with 23rd SETAC LCA 2017 audience**
  → share ideas and experiences