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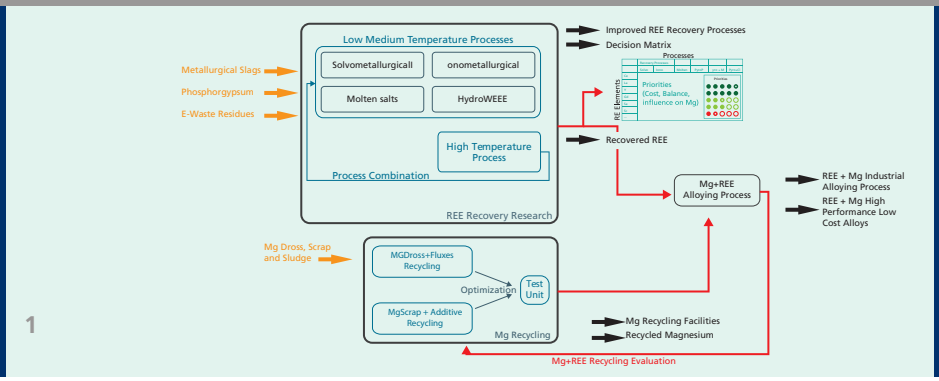

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Remaghic

WE PRODUCE RARE EARTH-MAGNESIUM ALLOYS OF HIGH PERFORMANCE AND LOW COST

1 *Process evaluation and industrialization flow chart.*

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Introduction

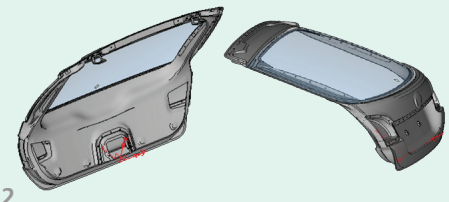
The project REMAGHIC started in September 2015 and is funded by the European Commission under the SPIRE 7 framework. It is focused on contributing to Europe's rare earth recovery and magnesium recycling technologies, improving the efficiency of these processes and advancing the Technology Readiness Level (TRL) for a new generation of industrial processes. The motivation of REMAGHIC lies on the fact that magnesium alloys can offer a significant weight reduction when compared to aluminium alloys. Addition of Rare Earth Elements (REE) improves the performance of Mg alloys significantly, though a price increase has to be taken into account. The consortium believes that by investing in recovery and recycling technologies, a new alloying process can be developed to yield low cost Mg+REE alloys. In order to do this, REE that are usually stockpiled (Ce, La) in favour of the most demanded ones (Nd, Dy) will be considered as attractive candidates to lower the price. This list of REE will be completed by other promising candidates found in industrial waste products such as mining residues and Waste Electrical and Electronic Equipment (WEEE) (e.g. Y, Gd, Sm). The project contributes to reducing the dependency from non-European supply of critical elements (REE and Mg) and to solving the REE Balance Problem.

Objectives

To evaluate the projects progress the following Key Performance Indicatores (KPI) were defined:

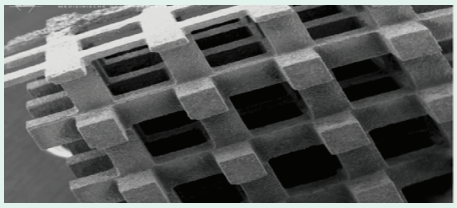
- KPI 1: Increase the rare-earth recovery processes efficiencies (>85 %) and the TRL level to 6.

Automotive use case: Tail-gate



Aeronautics use case: Injection nozzle collar

Biomedical use case: Patient-specific bone implants



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2 *Fig.2: Representative Potential Applications.*

- KPI 2: Improve magnesium recycling rates to obtain a more efficient recycling process with TRL 7 and a target efficiency of 80 %.
- KPI 3: Develop and characterize new magnesium alloys from 100% recycled raw material that meet the upcoming demands in the transport and biomedical sectors at a price of 3 €/kg.
- KPI 4: Increase sustainability of Europe's manufacturing processes, improving the environmental impact.
- KPI 5: Lower the dependency of exterior sources, sheltering Europe from supply shortages and contributing to solve the balance problem.

Recycling Processes

The REMAGHIC project works to advance different REE recovery processes and of magnesium recycling alternatives, so that new Mg+REE alloys can be developed in an efficient alloy process. This process will take the recovered REE as input and will be integrated in a unique facility with the magnesium recycling process. The main industrial processes to be evaluated and its expected results are shown in Figure 1.

The use of fully recovered materials will ensure that the cost remains competitive while the performance is comparative to a primary Mg+REE alloy. REMAGHIC innovation potential comes from the TRL update, from the combination of REE and magnesium recycling technologies and from the new developed alloys. The approach followed in the REE Recovery Strategy is to test the leading research processes and their combination trying to find and recover every REE that can be alloyed with Mg. A decision matrix has been constructed and will associate each element to the most cost-effective process, comparing the price of the recovered element with the primary one, and prioritizing this list according to cost and benefits when alloyed with Mg. This will be the key to decide the final Mg alloy composition for each targeted sector. From these processes the most promising combination of industrial feasibility and process efficiency will be taken up to TRL 6.

Show Cases

Three end users are part of the Consortium, which are the guarantee that the market point of view, the real requirements and needs from sectors as different as the transport and biomedical are represented and taken fully into account.

Three Use Cases (Fig.2) have been defined in order to obtain suitable alloy properties, and ensure that representative future applications are developed for its commercialization after the project.

Expected Future Impacts

Based on a Life Cycle Cost Analysis the single recycling processes will be evaluated according to their economic and ecologic performance. The selected process(es) will be upscaled to pilot plant level and together with the Mg recycling process integrated in an industrial facility. In the long term the consortium aims to achieve the following impacts:

- REMAGHIC project aims at achieving TRL 6 in the REE recovery process and TRL 7 for its recycling and alloying processes. The staged industrialization of each process will enable the consortium to demonstrate the real industrial feasibility of the process.
- REMAGHIC focuses on finding new applications for uncritical REE like cerium and lanthanum. Besides, REMAGHIC will also include REE, such as Y and Gd, recycled from other applications.
- This project will support the reduction in greenhouse gas emissions in transport industry without stressing natural raw material deposits.
- Achieve estimated energy savings of at least 40 %.

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