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Theme 4: Sustainable Innovation through Systems Approaches (Design Thinking for Sustainability)

Title (max 200 characters including spaces):

LCA of Mg+REE alloying ingots and their recycling processes developed in EU-project REMAGHIC

Keywords (max of 5 keywords and separate each by comma)

LCA, Magnesium, Rare earth elements, Recycling, Mg+REE alloy

Abstract (max 400 words)

The main objective of this work was the environmental assessment of the new technology for producing magnesium and rare-earth elements (Mg+REEs) alloying ingots developed in the EU-project REMAGHIC (New Recovery Processes to produce Rare Earth - Magnesium Alloys of High Performance and Low Cost, in the frame of SPIRE program, 01/09/2015-31/08/2018). Technologies to recover these two materials from waste sources have also been further developed within this project. The evaluation of the effective environmental performance associated with these new recovery processes supported the decision making process of selecting the most promising routes. These routes are planned to be applied in the upscaling process of the new production of Mg+REE alloying ingots. The LCA assessments were carried out following the standard ISO 14040/14044.

The scope of the LCA of the Mg recovery technologies was the assessment of the environmental profile of the production of 1 kg ingot of recovered magnesium from the available types of Mg wastes in Grupo Antolin facilities (in Spain). These ingots later will be alloyed with rare earths. The most promising waste stream of Mg recovery was based on the employment of magnesium scraps Type 1 (rejected parts, biscuits & gates, overflows), discarding the use of dross & sludges (scraps type 6A).

In the case of the rare earths recovery process developed within the project, the scope of the LCA was the environmental assessment of the production of 1 kg of REE, starting from the acquisition of powder (as waste material). The studied waste streams were fluorescent lamp phosphors, cathode ray tube (CRT) phosphors, and nickel-metal hydride (NiMH) batteries. The most promising waste stream of REE recovery was the NiMH batteries (Cerium (Ce) and Lanthanum (La), and the most promising process was based on a combination of the following three main technologies, a pyrometallurgical process to concentrate the REEs in a slag and a leaching process to extract the REEs from the slag (from Tecnalia, in Spain) and a ionometallurgical process (from KUL, in Belgium) to obtain a mixed La+Ce oxide.

These new processes to recover Mg and REE and to produce new alloys for automotive, aeronautical, and biomedical industries proven to be more sustainable in comparison to the processes associated to primary materials.