

Recycling of end of life NdFeB magnets



General Scope:

In the frame of a collaboration between CNRS-Institut Néel and ICBMS Lyon, your mission will be to develop a new recycling process of NdFeB magnets collected in urban mines. In the proposed process, sintered magnets collected in WEEE (Waste of Electrical and Electronic Equipments) are, first, pulverised into NdFeB powders. In a second step, the development of a non-conventional process for metal extraction (based on CO₂ capture) enables to recover the Rare Earth elements (mainly Nd and Pr) contained in those magnets. Thus, in this internship, attention will be given to study the influence of the processing parameters on the yield of the Rare Earth and Transition Metals elements recovery. As part of the two teams (and with experiments led both in Grenoble and Lyon), you will conduct tests and characterization (heat treatments, milling, DRX, Microscopy, CO₂ capture, extractive chemistry, Spectroscopy, ICP, etc...), exploit the results, report on the results (both written and oral reports).

Research topic and facilities available

In Néel Institute, you will benefit from the expertise of the TEMA group (Processing Elaboration Materials Applications) on the development of processes using magnetic fields, on the recycling processes as well as on the synthesis of alloys in various forms. The team led by Dr. Sophie Rivoirard has recently developed a valorisation process of NdFeB magnets, which is at the origin of the MagREEsources spin-off company. This process enables to extract the magnet from the electronic equipment. As a powder, the magnet is thus ready for further chemical treatment.

In ICBMS (Univ. Lyon 1/ CNRS/CPE-Lyon/ INSA-Lyon), you will benefit from the expertise of the team “Chimie Supramoléculaire Appliquée” led by Prof. Julien Leclaire. You will contribute to the development of an innovative process that already led to 2 patents, valorized in a spin-off company as well, called Mecaware. The process uses amines to capture the CO₂ present in combustion fumes and exhaust gases. These molecules and CO₂ are trapped together to form carbamates which in turn help capture and isolate rare earth metals. You will study and optimize the individual extraction of the main metals contained in the powders prepared by Néel, using CO₂-sourced ligands and both leaching, attrition and precipitation. This part of the project will implement the generation of ligands by CO₂ capture, the screening of extraction conditions, the composition analysis of the generated fractions, the study of the recyclability of the used agents.

Required skills:

- Interest in the recycling and the valorization of by-products.
- General curriculum with a specialty in Materials Science and Chemistry
- Autonomy, initiative and ability to work in a team and to adapt to a collaborative project (you will be the link between two teams in two different locations (Grenoble and Lyon))

Contacts:

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