

## Recyclage Aimants Permanents

Existe-t-il une filière de recyclage ? A priori il n'y a rien en France ; en Europe ?

### EUROPE

**Publication la plus détaillée sur le sujet, européenne (Fraunhofer, Leuven, etc.) et récente (septembre 2016)**

[REE Recovery from End-of-Life NdFeB Permanent Magnet Scrap: A Critical Review](#) (September 2016)

#### Abstract:

“This paper gives an overview of the sources of NdFeB permanent magnets related to their applications, followed by a summary of the various available technologies to recover the REEs from these magnets, including **physical processing and separation, direct alloy production, and metallurgical extraction and recovery.**”

At present, **no commercial operation has been identified for recycling the EOL NdFeB permanent magnets and the recovery of the associated REE content.** Most of the processing methods are still at various R&D stages. It is estimated that in the coming 10–15 years, the recycled REEs from EOL permanent magnets will play a significant role in the total REE supply in the magnet sector, provided that efficient technologies will be developed and implemented in practice.”

#### Institutions Contributors:

- Department of Materials Science and Engineering Delft University of Technology, The Netherlands
- School of Metallurgy and Materials, University of Birmingham, UK
- Fraunhofer ISC, Project Group IWKS, Hanau, Germany
- Institute of Material Science Technische Universität Darmstadt, Germany
- Resources & Transport Division Öko-Institut e.V. Darmstadt Germany
- Department of Chemistry and Chemical Engineering Chalmers University of Technology Göteborg, Sweden
- Department of Chemical Engineering, KU Leuven, Belgium
- Department of Materials Engineering, KU Leuven, Belgium
- Department of Chemistry, KU Leuven, Belgium

#### Réseau de recherche européen : DEMETER

Le projet [DEMETER](#) (Design and Recycling of Rare-Earth Permanent Magnet Motors and Generators in Hybrid and Full Electric Vehicles) (2015-2019) est un réseau de recherche européen financé à 100% par la CE (budget de presque 4M€) et qui travaille sur la thématique qui nous intéresse, appliqué aux véhicules (hybrides et électriques).

**Coordinator:** KATHOLIEKE UNIVERSITEIT LEUVEN, Belgium. Koen Binnemans  
([koen.binnemans@chem.kuleuven.be](mailto:koen.binnemans@chem.kuleuven.be))

**Participants (dont deux français !):**

- INSTITUT JOZEF STEFAN, Slovenia
- THE UNIVERSITY OF BIRMINGHAM, United Kingdom
- AALBORG UNIVERSITET, Denmark
- INSTITUT POLYTECHNIQUE DE GRENOBLE, France
- MAGNETI LJUBLJANA PODJETJE ZA PROIZVODNJO MAGNETNIH MATERIALOV DD, Slovenia
- VALEO EQUIPEMENTS ELECTRIQUES MOTEUR SAS, France

Tous les contacts [ici](#)

## DANEMARK

**Publication:** Technical University of Denmark

[Direct Reuse of Rare Earth Permanent Magnets—Coating Integrity](#) (December 2016)

“Rare earth permanent magnets can be reused directly as an alternative to traditional recycling methods, in which scrapped magnets are reprocessed into new magnets by undergoing many of the original energy-intensive and expensive production processes. Direct reuse entails using segmented magnet assemblies built by several small standard-sized magnets that can be reused directly in a number of different applications. A central part of the direct reuse strategy is to separate and demagnetize magnets by heating them to the Curie temperature. We investigated the validity of direct reuse as a rare earth magnet recycling strategy by evaluating the extent to which the heat-driven demagnetization cycles affected magnetic properties, as well as the integrity of the protective coating of Nd-Fe-B magnets (..)”

## ALLEMAGNE

**Publication:** Fraunhofer Institute for Silicate Research ISC - Project Group for Materials Recycling and Resource Strategies IWKS in Alzenau and Hanau

[Recycling permanent magnets in one go](#) (September 2015)

**A propos de l'article :**

“A new process route realized by [Fraunhofer](#) researchers will enable the fast and cost-effective recycling of these crucial materials.”

“The scientists have already set up a demonstration plant and have managed to recycle magnets there. The demo system can process up to half a kilogram of molten material and is somewhere between a lab and a large-scale plant”, Diehl goes on to specify. The researchers are now optimizing the properties of

the recycled magnets by varying the melt spinning process – such as the speed of the copper wheel, for example, or the temperature of the melted material during the rapid solidification process. Both influence the cooling rate and consequentially also the crystalline structure of the solidified material.”

**Dr. Eva Bertrand**

Fraunhofer Institute for Silicate Research ISC, Brentanostraße 2, 63755 Alzenau  
+49 6023-32039-866 - [Send email](#)

**Autres articles :**

[Recycling permanent magnets](#) (December 2015)

[Efficient Recycling of Rare Earth Permanent Magnets](#) (January 2016)

## FRANCE

### Article : CEA Tech institute, LITEN

Un article du CEA LITEN :

[Recycling permanent magnets to conserve rare-earth minerals](#) (June 2015)

### Initiative industrielle recyclage terres rares : Solvay

[Solvay launches its rare earth recycling activity in France](#)

On ne parle pas ici de recyclage d’aimants permanents à proprement parlé mais du recyclage des terres rares :

- [La Rochelle](#)
- [Saint-Fons](#)

## USA

### Urban Mining (entreprise – USA)

Une entreprise américaine (Texas) a apparemment commercialisé un processus de recyclage d’aimants permanents :

“[Urban Mining Company](#) has commercialized its process for producing recycled Nd-Fe-B type sintered magnets using our patent Magnet-to-Magnet™ process for producing recycled NdFeB type sintered magnets.”

Vidéo YT (2mn): [RECYCLING RARE EARTH PERMANENT MAGNETS](#)

## Autres :

Pour une approche plus mondiale, industrielle et “technico-economico-commerciale”, j’ai trouvé l’article suivant vraiment excellent (référez-vous directement à la partie « Recycling Opportunities ») : [“High Strength Permanent Magnets: An Untapped Source of Critical Rare Earth Metals but can the Metals be Economically Recovered?”](#)