RECYCLING PERMANENT MAGNETS

Léopold RÉMY, Gilles PHILIPPOT, Guillaume AUBERT, Cyril AYMONIER
CNRS, Univ. Bordeaux, Bordeaux INP, ICMCB, UMR 5026, F-33600 Pessac, France

Permanent magnets are metallic alloys with their own magnetic field. Nowadays there are four kinds of materials: ferrite, Al-Ni-Co, Sm-Co and Nd-Fe-B, which, because of their magnetic properties, are used in many technologies. For example, the hard disk drive (HDD) inside computers records data thank to their integrated Nd-Fe-B permanent magnet. Today, the magnets composed of rare earths (**Sm**-Co and **Nd**-Fe-B) have the best abilities and are the most used on the market.

Rare-earths being non-renewable and expensive, it is becoming paramount to find ways to optimize their use and to think about their recycling. For this purpose, recycling techniques have been developed: pyrometallurgy, hydrometallurgy, *etc*. At ICMCB, we develop a hydrothermal process to recycle Nd-Fe-B magnets. Using water under pressure and temperature for the recycling of Nd-Fe-B magnets represents a new ecological and economical route of collecting non-renewable and expensive rare-earth resources, which can be used for making new magnets for future technologies.

This method treats solid by using water as solvent. The hydrothermal treatment triggers a reaction between the solvent, water, and the Nd-rich intergranular phase, producing $Nd(OH)_3$ as the phase is consumed, leading to the collapsing of the ceramic into powder (see Figure 1). However, side reactions between solvent and the $Nd_2Fe_{14}B$ material can happen with the apparition of oxidised by-products such as Fe_2O_3 / Fe_3O_4 and $NdFeO_3$.

The objective being to find the best compromise between the pulverisation yield and the production of by products that can impact the magnetic properties, this talk will present the results of a parametric study regarding the impact of the ceramic pretreatment and the solvent pressure and temperature on the magnet pulverisation yield as well as on the by-products nature and quantity.

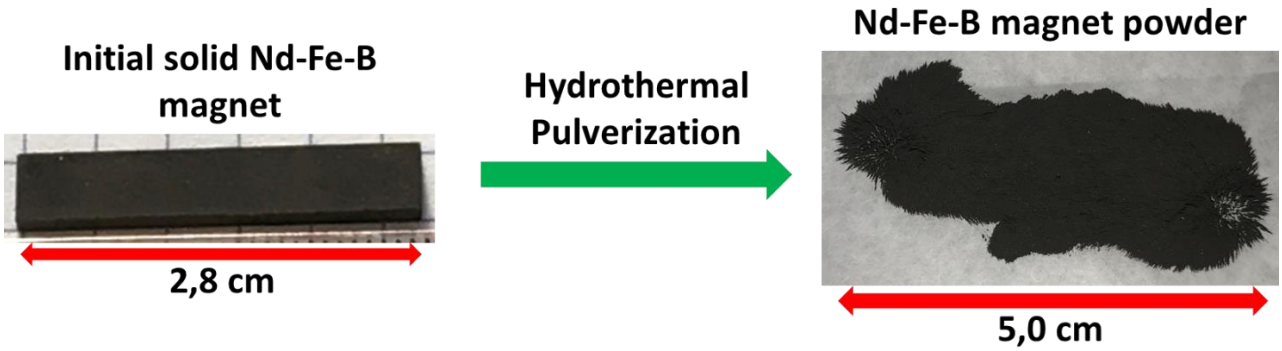

Figure 1: illustration of the hydrothermal pulverization of permanent magnet