Recovery of Rare Earth Elements from Small Scale Consumer Scrap Magnets – 1. Hydrometallurgy

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Recovery of Rare Earth Elements from Small Scale Consumer Scrap Magnets – 1. Hydrometallurgy

Motivation:

- Becoming more independent from primary REE supply & producers export quota
- Creating a recycling strategy to recover rare earth elements (REE) contained in NdFeB-based magnets (approx. 30 wt.-%) with less energy and chemical consumptions
- Increase of recycling rates and reduction of contaminants in consumer scraps for a closed raw material cycle and green environment

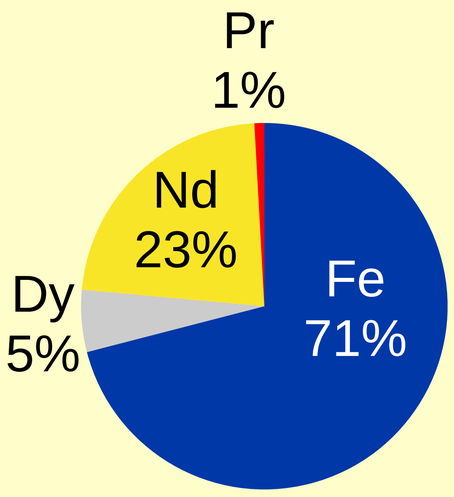
Magnets of used hard disc drives

Methods to enable the separation of rare earth elements and other impurities (Fe):

Objectives (leaching):

- Extraction of REE from the magnet scrap with high yields

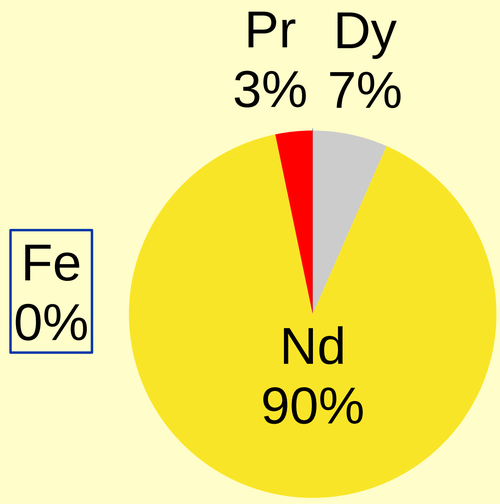
Metal content of the leachate



Objectives (precipitation):

- Separation of REE from the other dissoluted metals

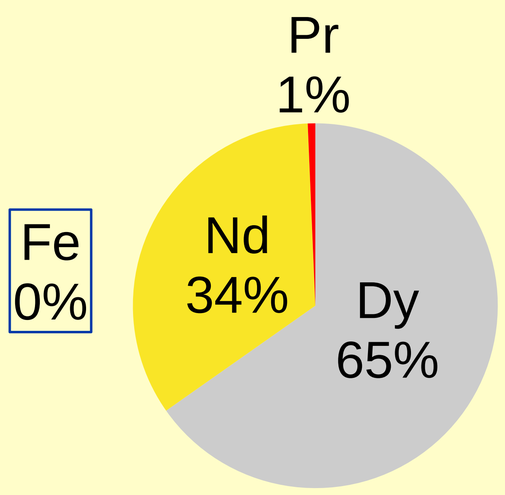
Metal content of the precipitate



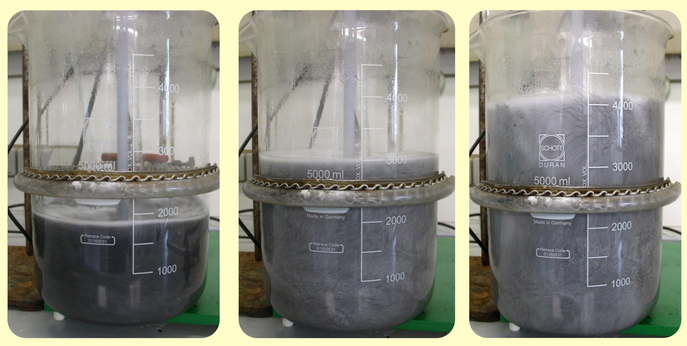
Objectives (solvent extraction):

- Extracting the remaining REE from filtrate

Metal content in the organic phase



1. Leaching

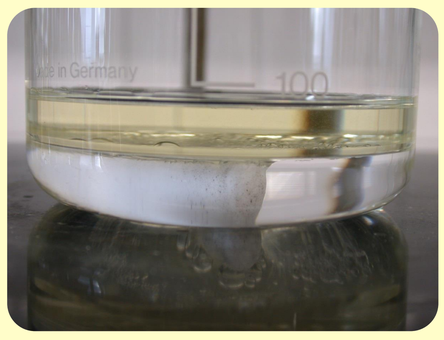


Strong exothermical reaction

2. Precipitation

Best separation at pH 2

3. Solvent extraction



Fast phase separation

Results:

1. Leaching: 100 % of iron and REE are leached with H_2SO_4 ⇨ high metal yield
2. Precipitation: 0 % of iron and 75 % of REE are precipitated with Na_2CO_3 ⇨ good separation efficiency
3. Solvent extraction: 0 % of iron and further 16 % of REE are extracted with HDEHP ⇨ high extraction yield for REE

Outlook:

- Investigation of the separation of Dy and Nd/Pr for a direct reuse in the magnet production (adherence to high quality standards)
- Development of a purification step to extract remaining impurities for a direct reuse and to build up an inner water cycle (no residues)
- Testing of slag phase coming from thermal preconcentrating step in developed hydrometallurgical process route

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