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Life cycle assessment of the pyrometallurgical and hydrometallurgical recycling routes used in rare earth recycling: A case study of NdFeB magnets

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To our knowledge, the environmental impact of different Rare Earth Element (REE) recycling routes has not been addressed in scientific literature. Thus, in our research, we set out to quantify the environmental impact of producing and processing 1 kg of neodymium magnets from two recycling processes, with a focus on hydrometallurgical and pyrometallurgical techniques. Magnets are the single largest application of rare earths, taking up 21% of the total rare earth production by volume and generating 37% of the total value of the rare earth market. Indeed the purpose of our study is to not to compare the impact of permanent magnet REE recycling with non-recycling before land filling, since this has already been done. The main goal is to compare the different pyrometallurgical and hydrometallurgical processes used in RE extraction and separation during the recycling process. Environmental impact results for such steps in the recycling processes could give stakeholders from the recycling industry essential information to assess the strategic potential of certain phases in the recycling process. In this paper, we will examine the two routes given by Dr. Koen Binnemans in his "Recycling of rare earths: a critical review" and perform a life cycle assessment (LCA) of NdFeB magnets to gain insight as to which route has a greater environmental impact.

Biography

Gwendolyn Bailey is currently pursuing her PhD. She has completed her Master of Science in Environmental Management and Sustainability, a dual degree offered by Université Catholique de l'Ouest in Angers, France and St. Edward's University in Austin, Texas. Her first publication titled, "Comparing Greenhouse Gas Emissions among Texas Universities" can be found in the January issue of Sustainabilty.

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