Poster | Raw materials

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[P2] Raw Materials & Recycling

Session Chair: Mr. Johann Fischbacher (University for Continuing Education Krems, Austria), Dr. Yusuke Hirayama (AIST, Japan)

[P2-21] Effect of milling on Particle Size and Magnetic Properties of Recycled $Nd_2Fe_{14}B$ Alloy Powder

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Development of indigenous technology to fabricate products like $Nd_2Fe_{14}B$ magnets are inevitable for any country to become self-sustainable in many sectors like automobile and electronics. Primary as well as secondary raw materials can be utilized for the fabrication of $Nd_2Fe_{14}B$ magnets. However, the mining and purification of REEs are least recommended for large scale production, when considering their availability and the negative impact of mining on nature. Recycling of existing magnets along with electronic devises like BLDC motors, hard disc drives, wind turbines, speakers, MRI machine, etc are the secondary source for REEs. In recycling, there are two methods in which extraction of individual elements from spent magnets is the long loop recycling and recycling of $Nd_2Fe_{14}B$ through Hydrogen treatment is the short loop recycling. Considering the cost of production and time consumption, short loop is option is the best available method for $Nd_2Fe_{14}B$ recycling. High temperature hydrogen treatment can dissociate the bulk $Nd_2Fe_{14}B$ in to NdH, α-Fe and FeB powder. This is reversible reaction which can be converted back to the original $Nd_2Fe_{14}B$ form through vacuum treatment followed by the high temperature hydrogen treatment. This treatment is known as Hydrogenation Disproportionation Desorption Recombination (HDDR) process [1]. HDDR process is the energy efficient, economical, and easiest method for recycling of NdFeB magnets. Spent NdFeB magnets from different E-Wastes can be converted into NdFeB alloy powder with the help of hydrogen with minimal oxidation and loss of magnetic properties. However, one of the major challenges in HDDR process is that the resultant NdFeB alloy powder will have larger particle size distribution and also will be difficult to grind into fine powder due to mechanically hard in nature. Hence, further milling is required to reduce the particle size to obtain fine NdFeB alloy powder suitable for magnet fabrication. Here, we report the effect of milling on the particle size and magnetic properties of HDDR processed NdFeB alloy powder. The changes in the crystal structure, elemental composition, morphology and magnetic properties of $Nd_2Fe_{14}B$ alloy powder in effect of HDDR process and milling process are traced using XRD, Particle size analyzer, ICP-OES, FE-SEM and VSM analysis respectively.