Effect of Hydrogen Decrepitation Temperature and Milling on Crystal Structure and Particle Size of End-of-Life NdFeB Magnets

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Abstract:

Recycling NdFeB magnets from secondary sources is a vital strategy for addressing the supply risks associated with critical raw materials such as Neodymium (Nd) and Dysprosium (Dy). Among various recycling methods, Hydrogen Decrepitation (HD) is recognized as an efficient process for recovering the end-of-life (EoL) magnets. This study aims to examine the impact of different HD temperatures on the crystal structure and particle size of milled HD-NdFeB. End-of-Life (EoL) NdFeB magnets were subjected to HD process at ambient pressures and varying temperatures between 30°C to 200°C. It was observed that increasing the HD temperature up to 50°C exhibits a shift to lower 2θ angles in XRD crystal patterns while further increasing the HD temperature resulted in reversed behavior. The optimum HD process, according to the XRD results, showed 92.7% $Nd_2Fe_{14}BH$ (Neodymium Iron Boride Hydride) along with some oxide phases.

It was revealed that following milling of the optimum HD powders, the crystallite size decreased from 12.512 Å to 302 Å and this reduction is accompanied by a dramatic shift to higher angles. Overall, the milling resulted in a particle size distribution of 10μm (D_v50).