

Metal Injection Moulding of NdFeB based on Recycled Powders

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Abstract

As the raw materials used for permanent magnets production is critical to the low carbon future envisioned by the European Union, the Horizon 2020 project Resource Efficient Production of Magnets (REProMag <http://www.repromag-project.eu/>) aims to address the issue of sustainability of RE permanent magnets by developing an innovative automated manufacturing route called SDS process (Shaping, Debinding and Sintering). This process will allow economically efficient production of net shape or near net shape magnetic parts with complex structures and geometries, whilst being absolutely waste-free through the use of fully recycled raw material and a 100% material efficiency in the consequent processing steps shaping, debinding and sintering. The REProMag SDS processing route is based on the use of powder obtained from end of life rare earth magnets by using the hydrogen decrepitation (HD) process. A proprietary binder system has been developed for producing a mouldable MIM feedstock, having a chemical composition optimised for the processing of the highly reactive magnetic powder. The first prototypes were processed in modified injection moulding equipment that were consequently debinded and sintered under tailored conditions. An overview of the project, including the processing steps and their challenges, the influence of debinding and sintering conditions on the microstructure and magnetic properties of isotropic sintered MIM parts are presented and discussed. Special attention is given to temperature control, gas pressure conditions and atmospheres during thermal debinding and sintering.

Keywords

Nd-Fe-B, permanent magnet, recycling, HD-process, metal injection moulding (MIM), REProMag