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Towards minimizing the consumption of Heavy Rare Earths in the processing of Nd-Fe-B permanent magnets by electrophoretic deposition**Marko Soderznik**

Jozef Stefan Institute, Slovenia

With their high performance, Nd-Fe-B sintered permanent magnets are the most promising candidates for a variety of transportation application. Heavy Rare Earths (HRE), such as Dy or Tb are inevitably used in Nd-Fe-B permanent magnets that exhibit high magnetic performance at elevated temperatures. Particularly, high coercivity of the magnets is important to oppose high demagnetization fields, caused in the electromotor. Drastic reduction of Dy or Tb consumption was achieved by using the grain-boundary diffusion process initiated by the electrophoretic deposition of nano TbF₃ particles. At the same time, the magnetic properties remained unaffected. Commercially available Nd-Fe-B magnets were coated by EPD with nano TbF₃. Scanning electron microscopy revealed uniform layer of nano TbF₃ which was well attached to the surface of the magnet. Good adhesion of powder is one of the main quality parameters for the successful grain-boundary diffusion process. Compared to simple dip-coating, EPD gives better adhesion of TbF₃ powder and consequently higher coercivity after the GBDP. The coercivity achieved after the EPD-based GBDP was 1536 kA/m at 75°C, which is nearly twice that of the uncoated sintered magnet and 1.5 times higher than that for the uncoated magnet exposed to the same heat treatment. To measure the accurate amounts of the elements, especially Tb, the chemical composition was determined with induction coupled plasma optical electron spectroscopy (ICP-OES). The microstructural investigation was done with a high-resolution field emission SEM. Core-shell-type microstructure was formed after the processing.

Biography

Marko Soderznik has completed his PhD at Jozef Stefan International Postgraduate School, Slovenia. He was a Postdoctoral Researcher at the National Institute for Materials Science in Tsukuba, Japan where he was studying magnetic domains and he is currently a Postdoctoral Researcher at Jozef Stefan Institute, Slovenia. He is the author or co-author of more than 30 scientific contributions and patents and a leader of Postdoctoral research project funded by the Slovenian Research Agency.

marko.soderznik@ijs.si

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