Research on the high coercivity in Sm_2Co_{17} permanent magnet and its microstructure

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RE-TM based compounds have been a subject of interest for many researchers due to their potential for magnetic application such as permanent magnets and magnetic-recording media. In particular they show a strong magnetocrystalline anisotropy which is mainly produced by RE ions as a consequence of the crystal field acting on the 4*f* electrons, and hence high coercivity (H_{cj}). In addition the TM sublattice is responsible for the large magnetic moment and high Curie temperatures characteristic of RE-TM compounds, also supplies a relevant contribution to the anisotropy, which is dominant at high temperatures. Recently, it has also shown the additives can enhance the coercivity effectively by refining the microstructure and modifying the grain boundary structure. In order to do this, many elements have been added to these alloys. In the present work, as far as 2:17 type rhomboedral (R/3m) SmCo sintered permanent magnets was concerned, the influence of Lu, Pr, Gd and Ga addition on crystal structure and magnetic properties of Sm_2Co_{17} compounds were investigated by using X-ray diffraction, transmission electron microscopy, and magnetic measurements, respectively. The result shows that both Lu and Gd additions have proved to result in relevant improvements in the microstructure and magnetic properties. The Lu addition has a greater effect on the coercivity H_{cj}, but Gd especially on $(BH)_{max}$, respectively. It is shown that the H_{cj} of Sm_2Co_{17} magnet is improved by an additional 6wt% Lu from 2067.2 up to 2832.2 kA/m, and the $(BH)_{max}$ is improved by an additional 5wt% Gd from 202.9 up to 217.3kJ/m^3. The enhanced mechanism for the excellent magnetic properties, especially for high coercivity, in the Sm_2Co_{17} sintered magnets was analyzed by their microstructure.

Keywords: 2:17 type SmCo; Sintered permanent magnets; Coercivity