Abstract Aru Yan:

The effect of Ce distribution on the magnetic properties of Nd-Ce-Fe-B sintered magnets

Recently, the efficient usage of rare earth element Ce, which possesses the merits of the low cost and high abundance, has attracted more attentions in the permanent magnetic society. Many efforts have been made to investigate the Ce substitution for Nd in Nd-Fe-B based sintered magnets. It was found that the coercivity of magnets could be drastically deteriorated after replacing Nd with Ce due to the poor magnetic hardness of Ce2Fe14B compared with Nd2Fe14B. On the other hand, the Nd-Fe-B sintered magnets mainly consist of the Nd2Fe14B matrix phases and rare earth element-rich boundary phases. Therefore, the high performance could be expected if Ce diffusion into the matrix phases Nd2Fe14B would be hindered or weakened for Nd-Ce-Fe-B sintered magnets. In this work, Ce distribution was tuned through the dual alloy method. It was found that the magnets with the dual alloys exhibit much better properties than the counterpart with the single alloy. Dual alloy powders were prepared by blending the Ce-free and Ce-containing single alloy powders, then the mixed powders were pressed in a DC magnetic filed to fabricate green body. The green body was subsequently sintered and annealed in vacuum furnace. Regarding the magnet with the dual alloys, the coercivity was enhanced from 10.3 kOe to 12.1 kOe and the remanence was increased from 13.1 kG to 13.3 kG in comparison to the magnet with the single alloy. Additionally, the remanence temperature coefficient α and coercivity temperature coefficient β was also slightly improved for the magnet with the dual alloys. Figure 1 shows SEM images and the elemental mapping of two magnets. It is very clear that the two magnets exhibit a different Ce distribution. Ce shows the uniform distribution for the magnet with a single alloy. For the magnet with the dual alloys, the Ce-rich and Ce-lean areas are coexisted as indicated with circles.Through the δm-H plots, the different coupling appears owing to different elemental distributions.