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Numerical simulation of magnetic properties of nano-structured $Nd_2Fe_{14}B/\alpha$-Fe multi-layered composite magnets

Hu Lianxi, Harbin Institute of Technology

ABSTRACT

The magnetic properties of nano-structured $Nd_2Fe_{14}B/\alpha$-Fe multi-layered composite magnets have been studied by numerical simulation based on micro-magnetic finite element method. The effect of the phase geometric parameter (layer thickness) and the volume ratio of $Nd_2Fe_{14}B$ to α-Fe on the magnetic properties, i.e., the coercivity, the remanence, and the energy product, have been clarified. The results have been interpreted by means of the exchange coupling effect between the nano-sized magnetically hard $Nd_2Fe_{14}B$ and soft α-Fe layers. Also, the dependence of the magnetic properties on the geometric anisotropy and magneto-crystallographic anisotropy has been studied. It is believed that the simulation results are very useful for the improvement of the magnetic properties by optimization of the geometry and microstructure design of such nano-structured $Nd_2Fe_{14}B/\alpha$-Fe multi-layered magnets.

KEYWORDS: nano-structured $Nd_2Fe_{14}B/\alpha$-Fe multi-layered magnet, magnetic exchange coupling, magnetic properties, numerical simulation