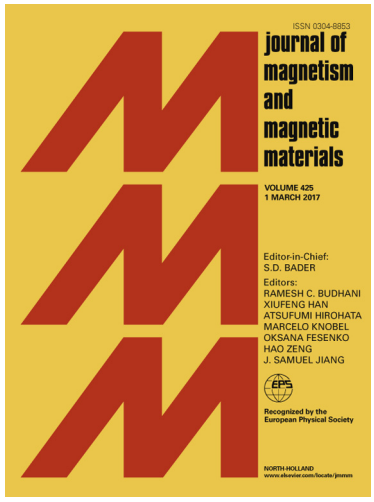

Reproduced multi-domain regions during demagnetization in $Nd_2Fe_{14}B$ sintered magnets with different average grain sizes

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Reproduced multi-domain regions during demagnetization in $Nd_2Fe_{14}B$ sintered magnets with different average grain sizes

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Abstract

We prepared five $Nd_2Fe_{14}B$ sintered magnets with similar saturation polarizations (J_s) of 1.38–1.43 T and anisotropy fields (H_a) of 6.76–8.49 T, but different grain sizes (D_{AV}) of 3.1–8.4 μm in diameter and obviously different coercivities ($\mu_0 H_c$) of 0.8–1.6 T. The observed difference in coercivity could not be explained by the Kronmüller equation, because of the similar H_a values and similar chemical compositions and microstructures resulting from similar preparation method except D_{AV}. The H_c values themselves, however, are inversely proportional to D_{AV}. During demagnetization after magnetization in a 5 T pulse field, domain wall motion (DWM) was observed except in the sample with $\mu_0 H_c$ = 1.6 T by using our step method. The DWM was also confirmed by susceptibility measurements using a custom-built vibrating sample magnetometer, and DWM was generated in the reproduced multi-domain regions (RMDR) during demagnetization. The magnitude of DWM as a polarization change in the RMDR was inversely proportional to the coercivities of the samples. Therefore, it should be considered that the propagation of the nucleated region through the grain boundary, which corresponds to the expansion process in previous studies, was different caused by, first, the difference in D_{AV}, and, second, in grain boundary state which was varied by difference in final annealing temperature.

Keyword: Nd-Fe-B sintered magnets, coercivity mechanism, susceptibility, nucleation process, quick-response VSM, step method