Direct observation of magnetization in Nd-Fe-B permanent magnets by transmission electron microscopy

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Among the permanent magnets currently available, sintered $Nd_2Fe_{14}B$ magnets show the best magnetic properties (K_u ~ 4.5 MJ m^{-3}, H_c ~ 1.1 MA/m, $\mu_0 M_s$ ~ 1.6 T); that is, they show the largest value of maximum-energy product [(BH)max > 400 kJm-3]. Since the large maximum energy product leads to a remarkable degree of miniaturization of motors and actuators, these magnets can significantly contribute to power saving and/or green technologies. In fact, Nd–Fe–B magnets have been applied in traction motors of hybrid electric vehicles, and as actuators of hard disk drives. In order to further improve both coercivity (H_c) and maximum-energy product $(BH)_{max}$, understanding the magnetization process and the magnetism at the ultrathin grain boundary (GB) region is of vital importance. In this talk, using *in situ* Lorentz TEM and electron holography, I present the observations of magnetization reversal and the magnetism at the ultrathin GB region in a thin film of sintered $Nd_2Fe_{14}B$ [1,2].

References

[1] H. S. Park, *et.al*, *J. Appl. Phys.* **97**, 033908(2005).
[2] Y. Murakami, *et.al*, *Acta. Mater.* **71**, 370(2014).