Nanomanufacturing: Conversion of antiferromagnetic hematite (α-Fe_2O_3) nanocubes to ferrimagnetic spherical barium ferrite ($BaFe_{12}O_{19}$) nanoparticles

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Recently, it has been shown that it is feasible to realize 29.5 Gb/in^2 recording density employing hexagonal barium ferrite (H-BaFe) nanoplatelets [1]. Although H-BaFe nanoplatelets are a potential candidate for high density recording media, their greatest disadvantage is their dispersibility and agglomeration by forming poker-chip-like stacks due to mutual magnetic interactions [2-3]. To achieve better media recording performance, use of nano-sized spherical barium ferrite (S-BaFe) particles has been previously proposed. Hence, we have developed 24 - 30 nm sized S-BaFe particles [4]. However, the particle size is still too large. In this paper, we report 20 - 25 nm sized S-BaFe particles having extremely narrow size distribution and no superparamagnetic phase. We have converted hematite nanoocubes to S-BaFe nanoparticles using an adsorption-diffusion process [4]. Fig. 1 (a, b) shows the TEM micrograph of the 21 nm hematite nanocubes and the converted 20 - 25 nm sized S-BaFe particles. Mössbauer spectra shown in Fig. 1 (c) clearly demonstrate that the converted particles are S-BaFe, and there is no superparamagntic phase owing to extremely narrow particle size distribution. The saturation magnetization and the coercivity of the S-BaFe particles were observed to be 45.4 emu/g and 3015 Oe, respectively.

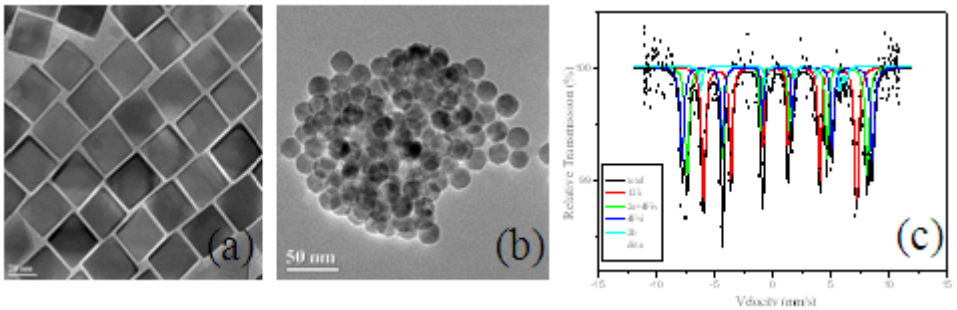

Fig.1. (a) TEM micrograph of 21 nm hematite nanocubes and (b) TEM micrograph of S-BaFe nanoparticles, and (c) Mössbauer spectrum of 20 - 25 nm sized S-BaFe particles.

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