Independent tuning of particle diameter and interparticle spacing in Ni nanoparticle systems

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Macroscopic properties of ferromagnetic-metal nanoparticle systems are strongly affected by two microstructural parameters; the diameter of constituent particles (*d*) and their spacing (*r*). Therefore, these parameters must be fine-tuned in order to design and realize a system for a specific purpose or application, e.g., ultra-high density magnetic recording media. Nevertheless, independent and precise modification of the *d* and *r* at the level of several nanometers still remains a challenge. In this contribution, the independent tuning of the *d* and *r* in ferromagnetic Ni nanoparticle systems has been reported.

Ni nanoparticles were chemically embedded in polymer films called polyimide by applying a surface modification technique. The structure of the films was characterized by transmission electron microscopy (TEM). The TEM observation showed that the thermal decomposition of the polyimide matrices brings about a decrease in the spacing *r* among Ni nanoparticles with an almost constant diameter *d*. Ferromagnetic resonance (FMR) in the films was investigated. The FMR studies clearly indicate that we have succeeded in controlling the magnetic dipolar interaction among Ni nanoparticles via independent tuning of *d* and *r*. The present study allows us to open a new way to realize tailor-made nanostructured magnetic materials.