

Synthesis and Magnetic Properties of Co Nanoparticles by Polyol Process

Seung I. Cha*, Chan B. Mo, Kyung T. Kim and Soon H. Hong, KAIST

1. Introduction

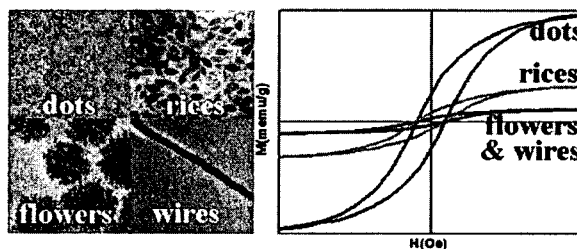
Uniform Co nanoparticles have been fascinated due to their outstanding magnetic properties and various promising applications such as high density recording media, magnetic fluids, drug delivery and gene therapy. In order to fabricate monodispersed Co nanoparticles, several processes have been proposed during the last decade[1-2]. Among the chemical processes, polyol process is one of the popular processes to obtain nanoparticles by a reduction of metallic salt with polyols with high boiling temperatures[3].

2. Experimental Procedure

The cobalt(III) acetylacetonate($\text{Co}(\text{acac})_3$), 1,2-hexadecanediol and various amounts of surfactants(oleylamine, oleic acid) were mixed within octylether and heated to refluxing temperature of 290°C in Ar atmosphere. After refluxing for 0.5~2 hours, the solution was slowly cooled down to room temperature on the heating mantel. The ethanol was added into the solution to precipitate the Co nanoparticles. And Co nanoparticles were separated from the solution by centrifugation. The separated Co nanoparticles were dispersed in n-hexane.

3. Results and Discussion

Various shape and size of colloidal Co nanoparticles were fabricated by polyol process without seeds. The rice-shaped Co nanoparticles with size of 30nm and aspect ratio of 1.8 can be fabricated into self-assembled form without assistance of surfactants. The addition of oleylamine makes the particle size and aspect ratio decreased and the addition of oleic acid makes the surface of particle faceted. The mixture of oleylamine and oleic acid produce various shaped Co nanoparticles including nano-prism, nano-wire and nano-flower according to its ratio, total amount of surfactant mixture and reaction time. The fabricated nanoparticles show the relationship between ferromagnetic properties and the size and shape of Co nanoparticles. These results show that the various size and shape of metallic nanoparticles can be fabricated by polyol process into controlled forms.



References

- [1] S. Sun, C.B. Murray, D. Weller, L. Folks, A. Moser, *Science* 287, 2000, 1989.
- [2] F. Dumestre *et al.*, *Angew. Chem. Int. Ed.* 41(22), 2002, 4286
- [3] G. Viau, F. Fievet-Vincent and F. Fievet, *Solid State Ionics*, 1996, 84, 259