

Magnetic Characterizations of Magnetite and Cobalt Ferrite Nanoparticles by Sonochemistry

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Magnetic properties of nanoparticles are interested in fundamental science such as macroscopic quantum tunnelling (MQT) [1, 2]. Understanding the magnetic properties of nanoparticles surely preludes many important applications of magnetic nanoparticles. The broad applications of magnetic nanoparticles include high-density information storage [3], ferrofluid technology [4], magnetocaloric refrigeration [5], magnetic resonance imaging (MRI) enhancement [6], and magnetically guided drug delivery [7]. So, a variety of chemical and physical preparative methods have been developed to produce materials with nanometer domain size, recently, the sonochemical method has been applied to fabricate stable ferromagnetic colloids [8].

Magnetic nanoparticles of iron and cobalt ferrite have been synthesized using a sonochemical method with iron chloride and cobalt chloride in our group [9]. We present here, the magnetic properties of iron ferrite and cobalt ferrite depending on the particle size. The resulting nanoparticles were characterized by various techniques, such as Differential Scanning Calorimetry (DSC), X-Ray Diffraction (XRD), Transmission Electron Microscopy (TEM), Vibrating Sample Magnetometer (VSM) and SQUID magnetometer.

The particle size by sonochemical method was different from the particle size by co-precipitation method in both of metal ferrites. In case of iron ferrite, particle size was slightly larger than without ultrasonic irradiation. The magnetization values were increased with ultrasonic irradiation. On the other hand, in case of cobalt ferrite, the particle size was smaller than particles that were without ultrasonic irradiation for the same reaction time. In addition to, the magnetization (M) vs. field (H) curve does not reach saturation at a magnetic field of 10kG and the magnetization value was decreased by increasing particle size. Therefore, in the sonochemical process, there might be some different mechanisms between two metal ferrites.

References

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