

Synthesis of Magnetite Nanoparticles and the Process of Forming Fe-based Nanomaterials

Abstract

A method and structure for making magnetite nanoparticle materials by mixing iron salt with alcohol, carboxylic acid and amine in an organic solvent and heating the mixture to 200-360°C is described. The size of the particles can be controlled either by changing the iron salt to acid/amine ratio or by coating small nanoparticles with more iron oxide. Magnetite nanoparticles in the size ranging from 2 nm to 20 nm with a narrow size distribution are obtained with the invention. The invention can be readily extended to other iron oxide based nanoparticle materials, including $M\text{Fe}_2\text{O}_4$ ($M = \text{Co}, \text{Ni}, \text{Cu}, \text{Zn}, \text{Cr}, \text{Ti}, \text{Ba}, \text{Mg}$) nanomaterials, and iron oxide coated nanoparticle materials. The invention also leads to the synthesis of iron sulfide based nanoparticle materials by replacing alcohol with thiol in the reaction mixture. The magnetite nanoparticles can be oxidised to $\gamma\text{-Fe}_2\text{O}_3$, or $\alpha\text{-Fe}_2\text{O}_3$, or can be reduced to bcc-Fe nanoparticles, while iron oxide based materials can be used to make binary iron based metallic nanoparticles, such as CoFe, NiFe, and FeCo Smx nanoparticles.

Figure 1



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