

BT08

Surfactant-Assisted Sol-Gel Auto-Combustion Synthesis of Sr-Hexaferrite Nanopowder Using Different Fuels and Basic Agents

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Sol-gel auto-combustion synthesis is a novel technique for producing Sr-hexaferrite with ultra fine particles using an exothermic reaction between metal nitrates and an organic fuel in a short time without need to the high temperature furnace and prolonged ball milling [1]. Addition of cationic surfactant with molecules composed from a hydrophilic head and hydrophobic tail, into precursor solution results in formation of reverse micelles in the gel. Placing the aqueous ions inside these micelles can be effective for controlling the growth of the particles. Surfactant has also the role of fuel in the combustion process [2].

In this research Sr-hexaferrite powder was synthesized by a sol-gel auto-combustion route using two different fuels (glycine and citric acid) and two different basic agents (ammonia and trimethylamine). N-decyltrimethylammonium bromide ($C_{13}H_{30}BrN$) was also employed as a cationic surfactant.

The results showed that: (a) The particles of the powder synthesized by citric acid is finer than the powder synthesized by glycine. (b) Using trimethylamine instead ammonia reduced the formation temperature of Sr-hexaferrite phase because of its alkyl groups which acts as an excess fuel, furthermore because of more removal gases from its ignition, the resultant powder was more porous and finer. (c) The surfactant decreased the particles size. Reduction of the particles size in the presence of surfactant also reduced the needed calcination temperature for the formation of Sr-hexaferrite phase. It is concluded that the finest crystallite size and the lowest calcination temperature have been obtained as 27.2 nm and 800°C respectively, in the presence of citric acid, trimethylamine and surfactant.

REFERENCES

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BT09

The Synthetic Method of Shape and Size Controllable Iron Oxide Nanoparticle

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The synthesis of iron oxide nanoparticle has been focused on recent research interest for the reason of their diverse potential applications. The synthesis of monodisperse nanoparticle is the most important, since the properties of these nanoparticles strongly depend on their dimensions. We have designed and prepared monodisperse, size & shape controllable, and highly crystalline nanoparticle. Metal-oleate complex consisting of metal precursors and sodium oleate is dissolved in water-ethanol-toluene solution, and the oleic acid is injected passivating the metal precursors. Also, we inject hydrazine to decompose the metal-oleic acid complex. Unfortunately most synthetic method produced few grams of nanoparticles. However we report the large scale synthetic method. We were able to synthesize about 20g of magnetite nanocrystals with low reaction temperature using hydrazine. Moreover, we control the particle size by varying the experimental conditions without size sorting process. The nanoparticles obtained were characterized by TEM, X-ray diffraction, X-ray absorption spectroscopy, X-ray magnetic circular dichroism, and Raman spectroscopy. Magnetite nanoparticle could be applied for MRI contrast agent, targeted drug delivery, magnetic hyperthermia for tumor treatment, biochip, and so on.