Synthesis and Magnetic Properties of Six-Lines Ferrihydrite Nanoparticles

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Abstract : Ferrihydrite is one of the distinct minerals in the family of oxides, hydroxides and oxyhydroxides of iron. It is a nanocrystalline material. It occurs naturally in different sediments, soil systems and also found in the core of ferritin, an iron storage protien. This material can also be synthesized by suitable chemical methods in laboratories. This is known as less crystalline Iron (III) Oxyhydroxide. Due to its poor crystallinity, there are very broad peaks in x-ray diffraction. Depending on the number of peaks in x-ray diffraction pattern, it is classified as two lines and six lines ferrihydrite. The average crystallite size for these two forms is found to be about 2nm to 5nm. The exact crystal structure of this system is still under debate. Out of these two forms, the six lines ferrihydrite is more ordered in comparison to two lines ferrihydrite. The magnetic behavior of two lines ferrihydrite nanoparticles is somewhat well studied. But the magnetic behavior of six lines ferrihydrite nanoparticles could not attract the attention of researchers much. This motivated us to work on the magnetic properties of six lines ferrihydrite nanoparticles. In this work, we present synthesis, structural characterization and magnetic behavior of 5 nm six lines ferrihydrite nanoparticles. X-ray diffraction and transmission electron microscope are used for structural characterization of this system. Magnetization measurements are performed to fit the data at different temperatures. Then the effect of magnetic moment distribution is also found. All these observations are discussed in detail.

Keywords : nanoparticles, magnetism, superparamagnetism, magnetic anisotropy

Conference Title : ICNNO 2017 : International Conference on Nanoscience, Nanotechnologies and Opportunities
Conference Location : Paris, France
Conference Dates : April 18-19, 2017