

Synopsis

This thesis examines different aspects of magnetic nanocrystal fabrication, and examines a number of different synthetic protocols. A variety of morphology and size of magnetite nanoparticles are investigated, including ultrafine nanoparticles, nanocubes, nano-truncated octahedra, nanospheres and microspheres. Core-shell nanostructures, stable aqueous/non-aqueous ferrofluids were also prepared. The thesis entitled “*Shape & Size-Tuned Magnetic Nanostructures and Ferrofluids for Biomedical and Industrial Applications*” includes 6 chapters.

Chapter 1 gives the general introduction and brief review of magnetic nanomaterials, recent development of magnetic nanomaterials, crystal structure, various synthetic route, methods to stabilise the magnetic nanocrystals in aqueous and non-aqueous fluid and their practical applications.

Chapter 2 cover the materials used for fabrication of magnetite nanocrystals, various assay such as Bradford’s assay, cytotoxicity assay. The as-synthesised nanocrystals have been characterised by dynamic light scattering, XRD, TEM, SEM, TG-DTA, magnetic measurements by PPMS, VSM and spectroscopic measurements such as Mössbauer, XPS, UV-vis, FTIR, ICP-AES, and Magneto-rheological properties.

Chapter 3 Core-shell nanostructures of superparamagnetic magnetite/maghemite with tunable size were synthesised by aqueous coprecipitation method. The phase transformation of magnetic NPs subjected to temperature or laser induced oxidation were also investigated. The aqueous ferrofluid were made by proper surface functionalisation with tetramethylammonium hydroxide, starch, dextran, aminosilane etc. The magnetically switchable rheological properties of oil based ferrofluid were also prepared.

Chapter 4 Magnetite nanocrystals were precipitated in alcohol-water mixed solvents of varying dielectric constant at two different temperatures. The key colloidal properties such hydrodynamic size and surface charge of nanocrystals born in polyol-water media were thoroughly investigated by light scattering method against ageing time, temperature.

Chapter 5 Highly monodisperse sphere, cube, truncated octahedra magnetite nanocrystals of size in the range of ultra small 6.5 nm to large 135 nm were fabricated. Detailed structural, morphological and magnetic properties were studied. The cytotoxicity assay on two different cell lines: HCT-116 and MDA-MB-426 were studied after incubation with magnetic NPs

Chapter 6 summarises the important outcome of data obtained from third to fifth chapter and it describes a major findings of the whole investigations carried out throughout the thesis with the highlights of the recommendations for future scope/research.

Date:

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