

STRUCTURAL MODIFICATION AND SELF-ASSEMBLY OF NANOSCALE MAGNETITE SYNTHESISED IN THE PRESENCE OF AN ANIONIC SURFACTANT

S. Malik,^a I. J. Hewitt,^b and A. K. Powell^{a,b}

^a Institute of Nanotechnology, Karlsruhe Institute of Technology, Germany

^b Institute of Inorganic Chemistry, Karlsruhe Institute of Technology, Germany

Many biological and industrial processes are crucially dependent upon the absorption of surfactants from an aqueous phase onto a solid surface. At the heart of this physical chemical process is the alteration of the interface properties caused by the adhesion and aggregation of the surfactant molecules at the solid surface.

Synthesis of magnetite (Fe_3O_4) in the presence of the surfactant sodium dodecyl sulphate (SDS) gives rise to a variety of nanoscale morphologies, some of which look remarkably similar to magnetite found in organisms, suggesting that similar processes may be involved. So, taking our inspiration from biology, where templates produce magnetite of defined shapes and sizes, we have been interested in investigating how surfactant molecules can similarly influence nanoscale magnetite formation e.g. Figure 1.

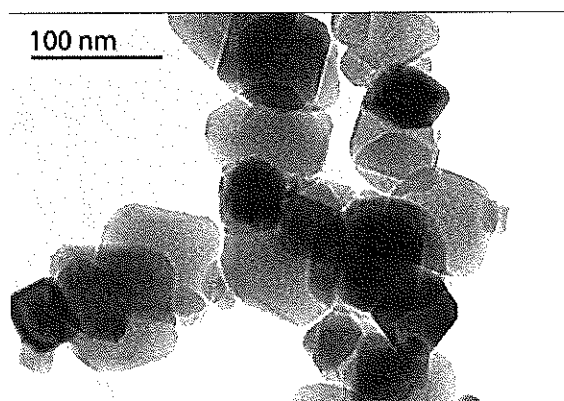


Figure 1. Mesoporous nanocrystallites form with diameters of 40-100 nm and a morphology similar to the widely reported truncated dodecahedral shape seen in certain magnetotactic bacteria [1]. In addition to its “biogenic signature” this mesoporous nanomagnetite could be useful for targeted drug delivery [2].

In this paper, we report structural modification and self-assembly of magnetite in the presence of the anionic surfactant SDS. SDS is commonly used to mimic hydrophobic binding environments such as cell membranes [3], and has recently been used to study the folding and thermal stability of cytochrome c (cyt c) a biologically important electron transfer system [4].

Literature: [1] R. M. CORNELL, U. SCHWERTMANN, *The Iron Oxides*, Wiley-VCH, Weinheim, (1996); [2] W. ANDRA and H. NOWARK, *Magnetism in Medicine*, Wiley-VCH, Berlin, (1998); [3] M. N. JONES, *Biological interfaces: An Introduction to the Surface and Colloid Science of Biochemical and Biological System*, Elsevier, Amsterdam, (1975); [4] Q. XU and T. A. KEIDLERING, *Protein Science* 13, 2949 (2004)