MAGNETIC NANOPARTICLES FOR DRUG DELIVERY

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INTRODUCTION: Drug targeting to reach a site of action, where a magnetic carrier can recognize and bind the target and/or provide opportunities for therapeutic action is a growing field of interest. Such an approach results in enhanced dosage at a defined specific site in a living system, with reduced side effects but higher efficiency in handling crucial biological problems. Up to date functionalised magnetic carriers have been mostly used for MRI imaging but superparamagnetic iron oxide nanoparticles consist in an important and promising mean for targeted drug delivery because of their high intrinsic magnetic moment, which allows a good magnetic guidance inside biological systems while still retaining no magnetic remnants.

METHODS: The aim of this research is to synthesize and characterize biocompatible particles before developing a setting for actual drug delivery application. The nanoparticles are synthesized by a chemical route namely co-precipitation of iron-based salts in aqueous medium. The obtained colloids are stabilised using various compounds such as dextran, starch, polyvinyl alcohol (PVA) and silica. The particles composition and morphology are characterized using TEM and other methods described in poster D3. SQUID magnetometry as well as AC susceptometry is used to investigate the magnetic characteristics of the particles.

RESULTS: TEM pictures show ellipsoidal particles. A statistical analysis based on hundred particles per sample lead to an average size in the 10nm range. From SQUID measurements the effective magnetic particle size is found to be smaller. The difference in the particle size measured with TEM and SQUID is thought to be due to the presence of a so-called magnetic "dead layer" with effective non-magnetic property around the particles core. Field cooled (FC) and Zero field cooled (ZFC) graphs show a superparamagnetic behaviour with a noticeable size distribution.

DISCUSSION & CONCLUSIONS: The preliminary studies revealed that stable ferrofluids at ambient temperature and neutral pH could be synthesised using various "bio-compatible" compounds as stabilisers. The magnetic characterisation mainly showed the existence of a "dead layer" around the particle core, which is an important point currently under study. The synthesis parameters need to be critically optimised in order to improve the particles size distribution and get a more homogeneous relaxation time of the superparamagnetic particle.

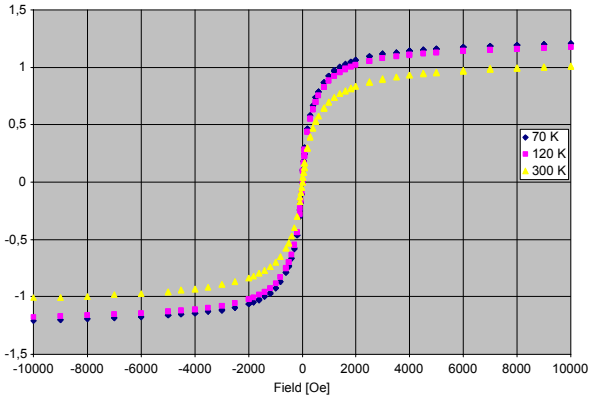

Fig. 1: The SQUID data measured at different temperatures show almost no hysteresis. The effective magnetic particle size is evaluated from the slope of initial curves around the origin.

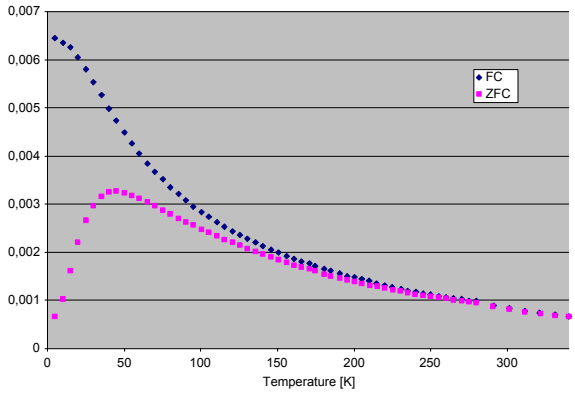

Fig. 2: FC and ZFC magnetisation curves are generally used to study superparamagnetic materials. Significant particle size distribution gives rise to the large difference between the maximum in the ZFC curve and the temperature at which the two curves overlap (around 170 K).

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