Single Crystalline Micrometric Magnetite for Magnetic Resonance Imaging

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A major drawback of using metal oxide nanoparticles as contrast agent in MRI is related to their low saturation magnetization mainly due to their particle size. The current works seeks to solve this problem by increasing the number of nanoparticles, of micrometer sized clustered particles. The studies shows that to be effective in improving MRI signal, millions of ultrasmall superparamagnetic iron oxide nanoparticles are needed to mark a single cell which is a dificulty. A better solution to this problem is to use singlecrystalline particles, in micrometer domain. Micrometric magnetite singlecrystals with average size of 10µm (along the <001> axis) with unusual superparamagnetic behavior at room temperature was synthesized by us through hydrotermal decomposition of Fe^{3+}-Na_4EDTA complex. Based on this lately original results regarding the obtaining of single crystalline micrometric domain (10-50µm) iron oxide (magnetite) with superparamagnetic behaviour generic named by as **SCMSPIO**, we believe that it could be involved in many interesting applications including their formulation as T_2 contrast agents for successfully exploring by MRI.

Single crystals of Fe_3O_4 with micrometric dimensions of 10µm and superparamagnetic behaviour were synthesized. We tasted these particles as contrast agent in MRI experiments and at this stage of experiments the nuances of grey which we obtained show promising effects and they correspond to our objective (see figures 1 an 2 presented below).

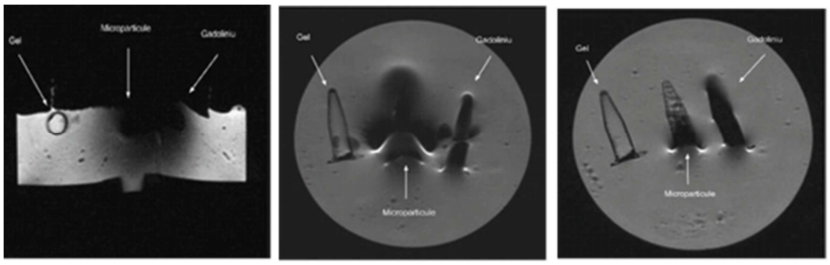

Fig. 1, Three representative phantoms

Fig.2, The grey nuances

The results indicate that the choice of appropriate concentration might give a good contrast in MRI applications. Further in vivo experiments on animals are in progress. Taking into account the dimensions of the cells (10µm -100µm), this particle could be appropriate for other medical applications such as intracellular hyperthermia, controlled drug delivery system (site specific drug delivery), cellular Magnetic Resonance Imaging (MRI), monitoring cell migration for cell therapy, multimodal cancer therapy, immunomagnetic separation of cells, detection, immobilization and modification of biologically active compounds, cell labelling; magnetic separation of cells, magnetic resonance contrast agents, gene delivery, multi-modal cancer therapy.

Keywords: MRI, superparamagnetic, magnetite, micrometric, biomedical.