

Magnetic nanoparticles as MRI and theranostic agents

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In the last two decades, a lot of attention was devoted to novel multifunctional nanostructures based on magnetic nanoparticles (MNP) useful as agents for Magnetic Resonance Imaging, Optical Imaging and Magnetic Fluid Hyperthermia, as carriers for drugs and molecular targeting vectors. Many systems reported by different research groups, showed high nuclear relaxivities, i.e. high efficiency in MRI contrast, and high Specific Absorption Rate (SAR). For some compounds, the possibility to collect images of the regions where the MNP are delivered through MRI and Optical Imaging, is joint to the use of radio-frequency fields that can heat locally the tumour cells, possibly inducing their apoptosis or death; a theranostic agent is thus obtained. In the field of drug delivery and molecular targeting, few examples of reproducible experiments using superparamagnetic nanoparticles are actually present in literature. All the above cases, with particular attention to the case of MRI contrast agents and the related nuclear relaxation models, will be briefly introduced and discussed.