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MagnetoTheranostics RTD 2013

FNSNF

Characterization of iron oxide nanoparticles for theranostic applications

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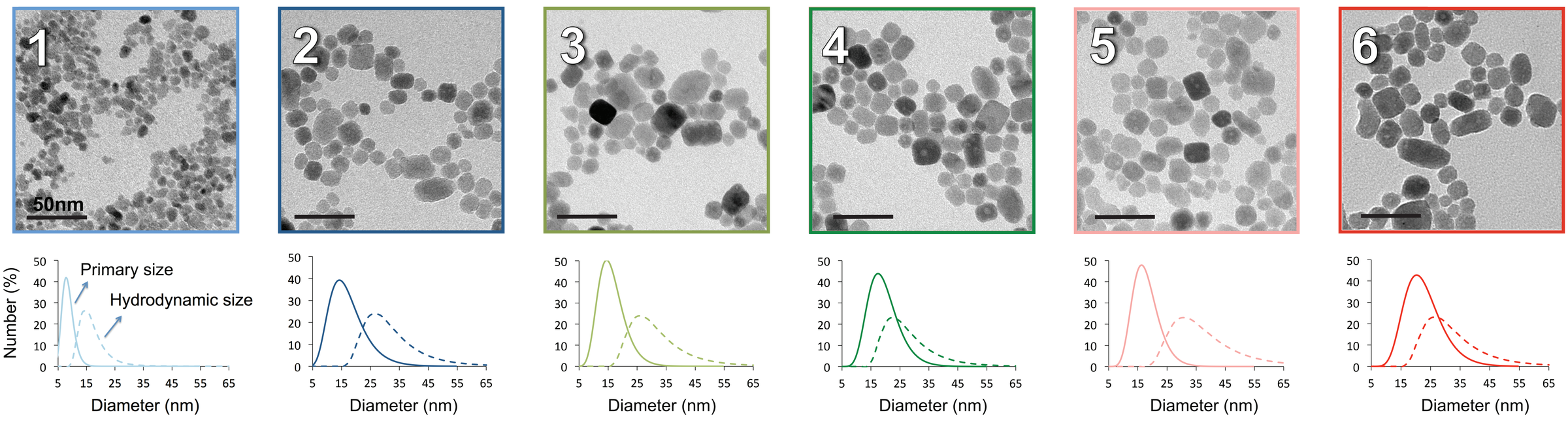
Introduction

Superparamagnetic iron oxide nanoparticles (SPIONs) are successfully used for tumor detection by magnetic resonance imaging (MRI), but they display poor heating capabilities for tumor treatment by hyperthermia.

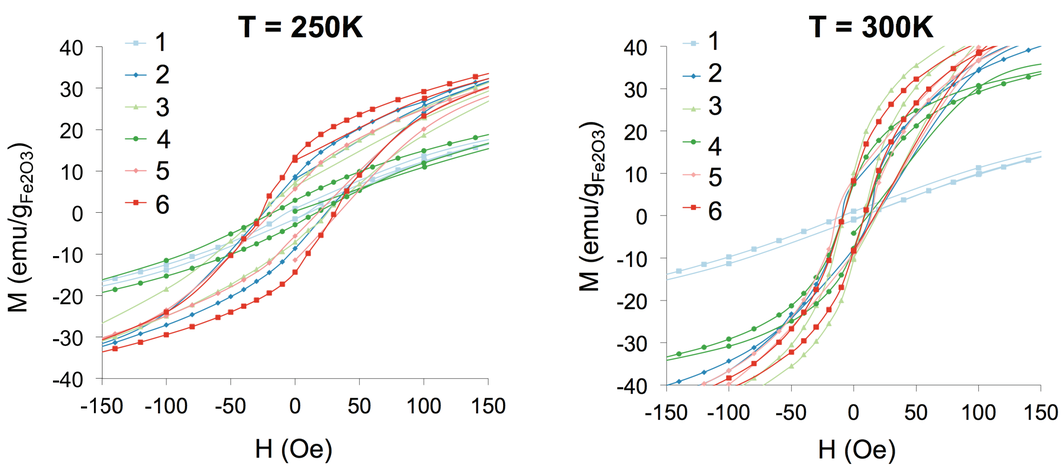
-> Here, we focus on optimazing SPIONs size and magnetic properties to increase heating capabilities for hyperthermia, given by the specific loss power (SLP; W/g_{Fe})

Synthesis of SPIONs with different sizes

Increasing SPIONs' diameter



Magnetic properties



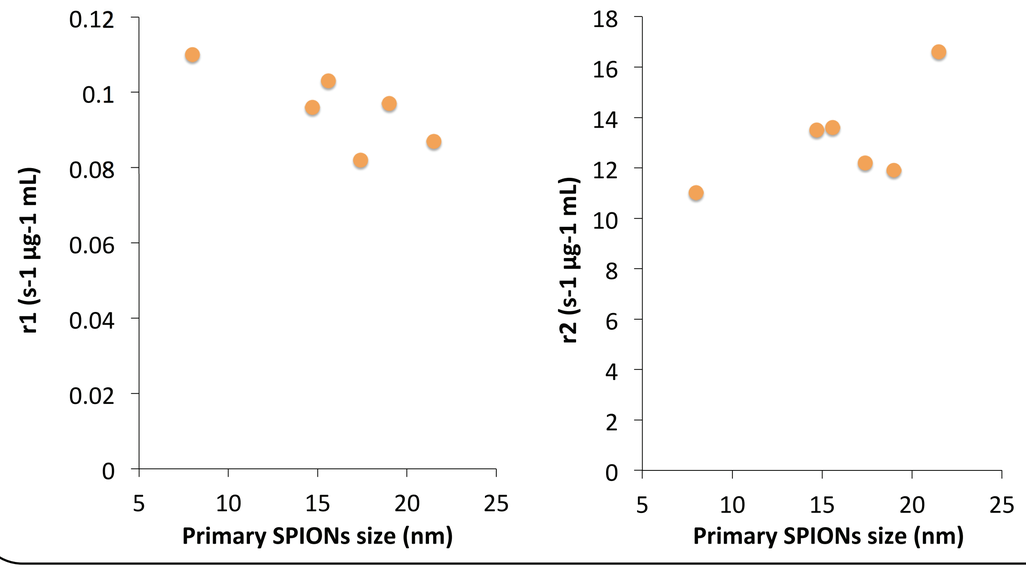
X magnetic susceptibility, M magnetization, H magnetic field strength

Summary of SPIONs' properties

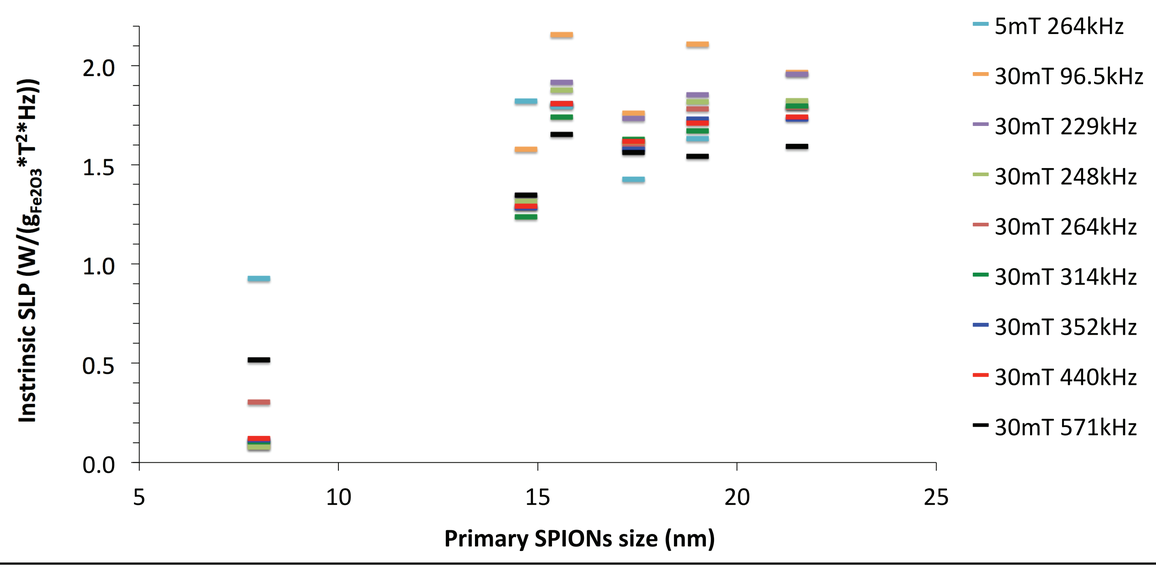
	1	2	3	4	5	6
Primary size (nm)	8.0 ± 1.9	14.7 ± 5	15.6 ± 4.7	19.0 ± 5.7	17.4 ± 4.7	21.5 ± 6.3
Crystallite size (nm)	8.7	13.2	14	13.7	17.8	18.2
Hydrodynamic size (nm)	17.7 ± 5.8	26.9 ± 8.5	29.5 ± 8.5	25.8 ± 7.8	35.1 ± 10.6	30.2 ± 9.1
M_s* at 300K (emu/g_{Fe2O3})	65.6	74	77.2	69.9	71.1	72
H_c at 250K (emu/g_{Fe2O3})**	10	25	25	20	20	30
H_c at 300K (emu/g_{Fe2O3})**	8	9	8	10	9	9
M_r* at 250K (emu/g_{Fe2O3})**	0.9	8.1	6.3	5.7	2.9	12.5
M_r* at 300K (emu/g_{Fe2O3})**	1.0	7.6	10.1	8.7	7.5	8.3

* M_s saturation magnetization, ** H_c coercivity, *** M_r remanent magnetization

T1- and T2- relaxivities for MRI



Heating efficiency (SLP) in function of SPIONs' size



Magnetic measurements were performed by A. Millan, R. Pinol and A. Martinez (Instituto de Ciencia de Materiales de Aragon,Universidad de Zaragoza), as well as by B. Sanz and G. F. Goya (Instituto de Nanociencia de Aragon,Universidad de Zaragoza).