# Tailoring magnetic nanoparticle properties towards applications


## Claudio Sangregorio

ICCOM – CNR and Dept. of Chemistry “U. Schiff” – Univ. of Florence Polo Scientifico di Sesto Fiorentino, (FI), I-50019 Italy
e-mail: csangregorio@iccom.cnr.it


Magnetic nanoparticles, MNP, are expected to have a tremendous impact on several technological fields, ranging from electronics, to spintronics and clinical applications, one of the most prominent reason relying on the possibility of fine tuning their physical properties to match the required optimal values. The feasibility of such a control requires the exact knowledge of the effect of the size, morphology, structure and chemical composition on the magnetic properties of the final product. However, large piece of information is still missing, mostly because of the difficulty in controlling independently each one of these parameters. However, the recent development of wet-chemistry syntheses has boosted renewed promises in the field.
In this contribution, we show how some phenomena characteristic of the nanoscale could be advantageously exploited for improving the performances of magnetic nanoparticles in several technological fields. In particular, we will discuss the state-of-the-art of the application of magnetic nanostructured materials and the future perspectives for a more extended use in two of the most prominent research areas in the field: the realization of a new class of theranostic agents, combining the therapeutic effect of targeted drug-delivery with hyperthermia and enhanced relaxometric properties, [1] and the quest for novel materials that can replace currently used Rare Earth (RE) compounds in a wide part of the spectrum of energy industrial necessities where the high performances of RE permanent magnets are not strictly required. [2-4]


[1] E. Fantechi et al. ACS Nano, 2014, 8, 4705-4719
[2] A. Lopez-Ortega et al. Chem. Mater. 2015, 27, 4048-56
[3] E. Lottini et al. Chem. Mater. 2016, 28 4214–4222
[4] A. López-Ortega et al. Chem. Mater. 2017, 29 1279-1289