**MAGNETIC NANOPARTICLES FOR CONTROL ASSEMBLY, TUMOR THERAPY AND IMAGING**

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Magnetic hyperthermia exploits the heat generated by magnetic nanoparticles under an externally applied time varying field, at a kHz frequency, to locally raise the temperature and overheat tumour cells, causing direct damage to them without secondary effects to neighbouring healthy tissues. This is based on the limited ability of cancerous masses to dissipate the heat. The same magnetic particles can be exploited as contrast agents in magnetic resonance imaging (MRI) for monitor the NP tumour distribution and as tracers in magnetic particle imaging (MPI) for quantify the nanoparticle accumulation at the tumour. The aim of my group in collaboration with the host groups at CUI, Prof. Bigall and Prof. Parak, is to develop a new generation of magnetic nanoparticles/magnetic tools (capsules, vesicles, polymer beads etc.) with benchmark magnetic heating ability under clinical applicable magnetic fields and study their MRI contrast and MPI signal under different conditions. For the combination with these scaffolds' materials, we will select our magnetic nanoparticles based on their gold standard heating performance for magnetic hyperthermia treatment even when wrapped in a scaffold matrix or when administered in viscous tumour microenvironment.

Here I will introduce our synthesis methods and magnetic nanoparticles, our approach to assemble the magnetic nanoparticles in clusters at controlled geometries and our efforts to scale up the production of magnetic nanoparticle and magnetic assemblies. I will anticipate some of the future activities we will carry out between IIT-CUI. The investigation of these new synthesised materials will be carried out with different techniques available at both institutions including structural and magnetic characterizations and tested for different proof-of-concepts applications.