Magnetic materials for curing cancer

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About the Project

The use of magnetic nanoparticles in various biomedical applications is gaining momentum thanks to the multifunctional properties of these peculiar nanomaterials. Among them, the use of magnetic nanoparticles as heat mediators in magnetic hyperthermia represents a new form of cancer therapy now in clinic for the treatment of Glioblastoma Multiforme tumor. With this method, tumor cells are burnt by increasing the temperature at the therapeutic range of 43-46°C generated by magnetic nanoparticles when exposed to a time varying field (a radiofrequency in the kHz regime). For this application, it is crucial to maximize the heating efficiency of magnetic nanoparticles under a kHz-radiofrequency of clinical use and under intratumoral conditions.
The PhD project aims at develop synthetic procedures for magnetic nanoparticles production yielding multifunctional magnetic nano-heterostructures specifically designed for magnetic hyperthermia, with focus on setting scaled-up preparative approaches. The PhD student will aim at tuning synthesis parameters to obtain magnetic materials at controlled composition, size, shape and crystallinity of the multi-domains heterostructures. Accurate physical/chemical studies will be carried out to correlate the magnetic /structural parameters to the magnetic hyperthermia heat efficiency not only in aqueous media but also under conditions that simulate the tumor microenvironment. The candidate will also aim at setting up scale up approaches for the gram scale production of nanomaterials and, at the same time, developing methodology that are eco-sustainable, to obtain nanoparticles/heterostructure by procedures at minimal environmental impact. The ideal candidate should be able to develop his/her own ideas on the present topics while having a well-defined attitude to collaborate within an international and interdisciplinary team.

Requirements: The ideal candidate must have a Master's Degree or equivalent in Chemistry or cognate discipline, with strong interest in synthesis of magnetic nanoparticles, structural characterization of nanomaterials, such as Transmission Electron Microscopy (TEM), X-Ray Diffraction (XRD), calorimetric measurements and data processing for Specific Absorption Rate (SAR) determination, high frequency hysteresis measurements, etc

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