Surface and crystal volume engineered of colloidal heterostructures for targeted radio-therapy and thermal-therapy

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About the Project

Magnetic-plasmonic nanoheterostructures enable to combine magnetic hyperthermia with plasmonic hyperthermia. Furthermore, semiconductor-based heterostructures can be also employed in cation exchange reactions to insert radiotherapy in the crystal structure of the semiconductor domain. Furthermore, the heterostructure surface can be modified with tumor ligand molecules to selectively redirect the heterostructures against tumor cells. All these features makes the heterostructures appealing for tumor treatment by exploiting a multimodal approach. The aim of this project is to develop protocols to tune the crystals composition and the surface of inorganic hetero-structures composed of at least two distinct domains, one magnetic, and one based on semiconductor, to merge magnetic hyperthermia, photo-ablation, radiotherapy while being able to selectivity target cancer cells. At the same time, the PhD student will acquire knowledge on characterizing those materials as imaging probes in magnetic resonance imaging, magnetic particle imaging, and positron emission tomography.

Requirements: The ideal PhD candidate with a preferable background in material science and chemistry will develop new skills on surface functionalization of heterostructures, material characterization and post synthesis manipulation of such inorganic heterostructures, including structural transformation (such as intercalation reaction with radioisotopes). Also as a part of his/her research the candidate will develop procedure for water transfer and stabilization in saline media and surface modification of these nanoparticles to make the nano-heterostructures specific towards bio-molecular targets associated to cancer or for sorting and detection applications. The candidate will be a member of a multidisciplinary team composed of chemists, biologists, physicists and engineers. At IIT, state-of-the-art chemistry and a full equipped material characterization facility is available together with biology laboratory for in vitro and in vivo characterizations.

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