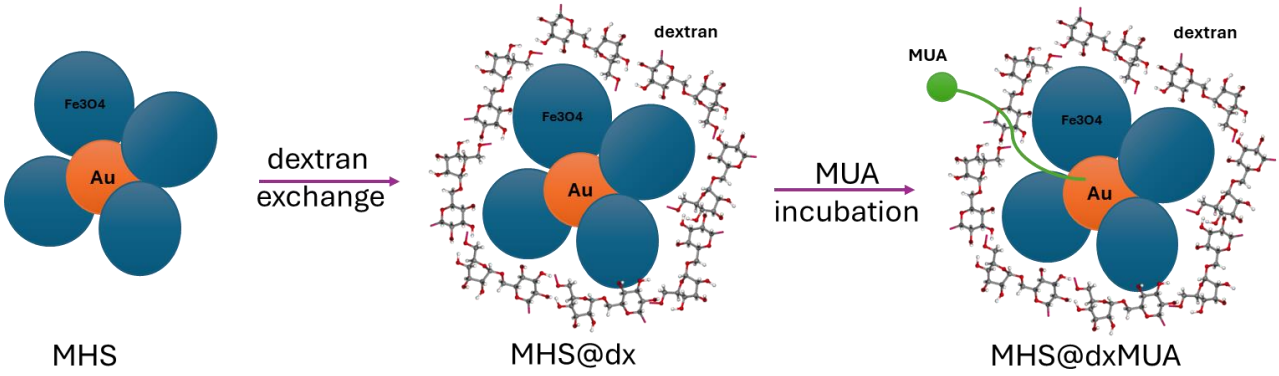
DIFFERENTIAL FUNCTIONALIZATION OF MULTI-DOMAIN MAGNETO-PLASMONIC GOLD-IRON OXIDE HETEROSTRUCTURES FOR BIOMEDICAL APPLICATIONS

Giorgio Capuzzello[1], Rosaria Rinaldi[1] and Riccardo Di Corato[2,3]
[1]Department of Mathematics and Physics "Ennio De Giorgi", University of Salento, Via Arnesano SNC, Lecce, 73100, Italy, giorgio.capuzzello@unisalento.it; [2]Institute for Microelectronics and Microsystems (IMM), CNR, Via Monteroni, Lecce 73100, Italy; [3]Center for Biomolecular Nanotechnologies, Istituto Italiano di Tecnologia, Arnesano 73010, Italy

Monodisperse water-transferred and multi-functionalized heterostructures, based on gold and doped-iron oxide nanodomains, were produced in order to combine the properties of Super-Paramagnetic Iron-Oxide Nanoparticles (SPIONs) with the optical properties of Gold Nanoparticles (AuNPs), and to exploit their activity in biomedical applications (*e.g.* MRI, hyperthermia, bio-sensing). Dopant elements incorporation inside the iron oxide lattice has been studied by elemental analysis using Inductively Coupled Plasma (ICP), and their influence on the shape and size of the magnetic nanodomains was evaluated through TEM analysis. The Magneto-plasmonic HeteroStructures (MHSs), synthesized using the thermal decomposition method, were made compatible with biological environments by a dextran coating with higher affinity for the iron-oxide and functionalized using thiolated molecules (*i.e.* mercaptoundecanoic acid, MUA) for the gold domain, obtaining a differential functionalization of the individual domains of the heterostructures. Different approaches have been attempted in order to prove the occurrence of Au-MUA binding, including Z-potential analysis, ICP-OES, Fourier-Transform InfraRed Spectroscopy (FT-IR) and X-Ray Fluorescence Spectrophotometry (XRF).



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REFERENCES

[1] E. Fantechi et al., "Seeded Growth Synthesis of Au-Fe3O4 Heterostructured Nanocrystals: Rational Design and Mechanistic Insights," *Chem. Mater.*, vol. 29, no. 9, pp. 4022-4035, 2017.
[2] R. Di Corato et al., "Maghemite Nanoparticles with Enhanced Magnetic Properties: One-Pot Preparation and Ultrastable Dextran Shell," *ACS Appl. Mater. Interfaces*, vol. 10, no. 24, pp. 20271-20280, 2018.
[3] T. D. Schladt et al., "Au@MnO Nanoflowers: Hybrid Nanocomposites for Selective Dual Functionalization and Imaging," *Angew. Chem. Int. Ed.*, vol. 49, no. 24, pp. 3976-3980, 2010.