MICROFLUIDICS, A TOOL TO PRODUCE HETEROSTRUCTURED NANOMATERIALS Au-Fe_3O_4 FOR BIOMEDICAL APPLICATIONS

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The production of nanocomposites involving magnetic and metallic elements has attracted much interest because of their potential applications such as drug delivery, tissue engineering, magnetic resonance imaging (MRI), cancer therapy and nanodiagnostics [1].

Iron oxide nanoparticles are one of the magnetic nanoparticles widely used for biomedical applications, because of their low toxicity, chemical stability and biocompatibility [2]. Moreover, the anchoring of gold nanoparticles to the surface of the iron oxide, improve their stability and increase their functionality, therefore the range of applications in which they can be used.

In the past decade micro-reactors have emerged for the highly controlled nanoparticle synthesis, offering multiple advantages over conventional synthesis method in which the reactor “batch” is used. These benefits include improvements in the crystallization process, good reproducibility and automation of the process. Laminar flow micro-reactors, however, are not enough suitable for the synthesis of nanoparticles with fast growth kinetics or where the presence of a specific reaction atmosphere is necessary. Segmented flow reactors are a good alternative, using an immiscible fluid (liquid or gas) to isolate the reagent segments. Key advantages of segmented flow include removing the dispersion, control of the reaction atmosphere and reduced reactor fouling [3].

This work has focused on the synthesis and characterization of hybrid nanomaterials based on iron oxide and gold (see Figure 1), for use in biomedical and catalytic applications. This synthesis was carried out using a segmented flow reactor under 4 minutes residence time in an aqueous media.

References

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[2] M. P. Calatayud, et.al, *J. Mater. Chem. B* 1, **Neuronal cells loaded with PEI-coated Fe_3O_4 nanoparticles for magnetically guided nerve regeneration** (2013) 3607.

[3] A. M. Nightingale and J. C. Demello, *Adv. Mater.* 25, **Segmented flow reactors for nanocrystal synthesis** (2013) 1813–21.

Figures

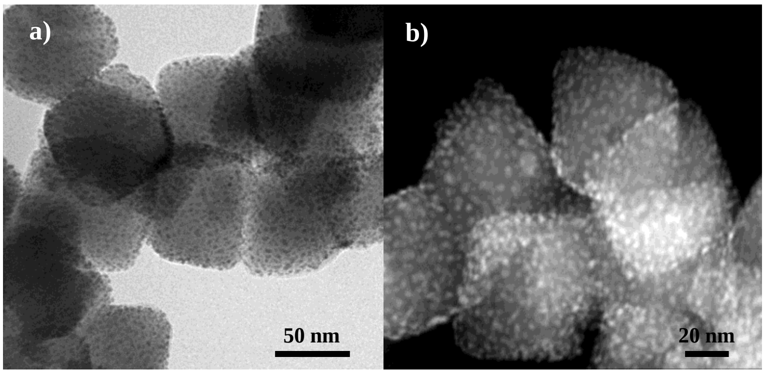

Figure1. Heterostructured nanoparticles Au-Fe_3O_4 obtained using segmented flow micro-reactor: a) TEM. b) STEM-HAADF.