Understanding the synthesis of Au-Fe_3O_4 nanocrystals for biomedical applications

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The continuous development and evolution of nanotechnology requires the design and optimization of high-engineered materials for widespread applications.[1] In this sense, one of the most versatile strategies is the growth of hybrid heterostructures combining at least two different properties (optical, magnetic, catalytic,…) into a single entity.[2] Interestingly, the functionality of such nanostructures can be tailored by the synergic combination of the diverse properties of each counterpart. One example is the gold-magnetite system, where magnetite nanoparticles are used as T2 contrast agents in magnetic resonance imaging (MRI) and nano-heaters in magnetic hyperthermia.[2] On the other hand, gold particles can be imaged by optical means or by X-ray computed tomography due to its large Z number. Moreover, gold nanoparticles are able to generate heat by the absorption of light due to their unique surface plasmon resonances (photo hyperthermia).

In this work we will show different strategies to tune the size and morphology of Au-Fe_3O_4 nanostructures based on thermal decomposition approaches, ensuring an intimate contact between both phases.[3] In fact, exploring the reaction parameters allows us to understand the reaction mechanism and thus to control the final morphology of the nanostructures (Fig. 1). The magnetic and optical properties of the nanoparticles are rather dependent on the size and morphology of the nanostructures. Finally, the nanostructrures were transferred to aqueous media in order to be tested as theranostic agents (MRI, hyperthermia).

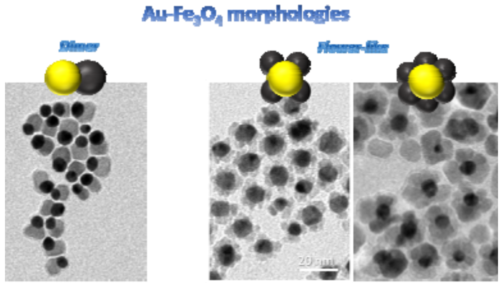

Figure 1. TEM images of Au-Fe_3O_4 nanostructures synthesized by thermal decomposition

References

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