Synthesis and Characterization of Hyper Branched Nanoparticles with Magnetic and Plasmonic properties

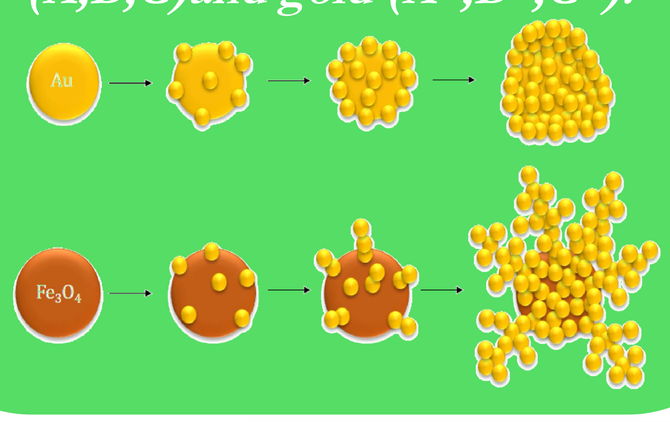
Angela Candreva[a,b], Francesco Parisi[a], Rosa Bartucci[a,c], Rita Guzzi[b,c], Giuseppe Di Maio[a], Francesca Scarpelli[a], Iolinda Aiello[a,b], Nicolas Godbert[a] and Massimo La Deda[a,b]

[a]Department of Chemistry and Chemical Technologies, University of Calabria, 87036 Rende (CS), Italy; [b]CNR NANOTEC- Institute of Nanotechnology U.O.S. Cosenza, 87036 Rende (CS), Italy; [c]Department of Physics, University of Calabria, 87036 Rende (CS), Italy

angela.candreva@unical.it

Hydroxylamine concentration determines the final nanoparticles shape

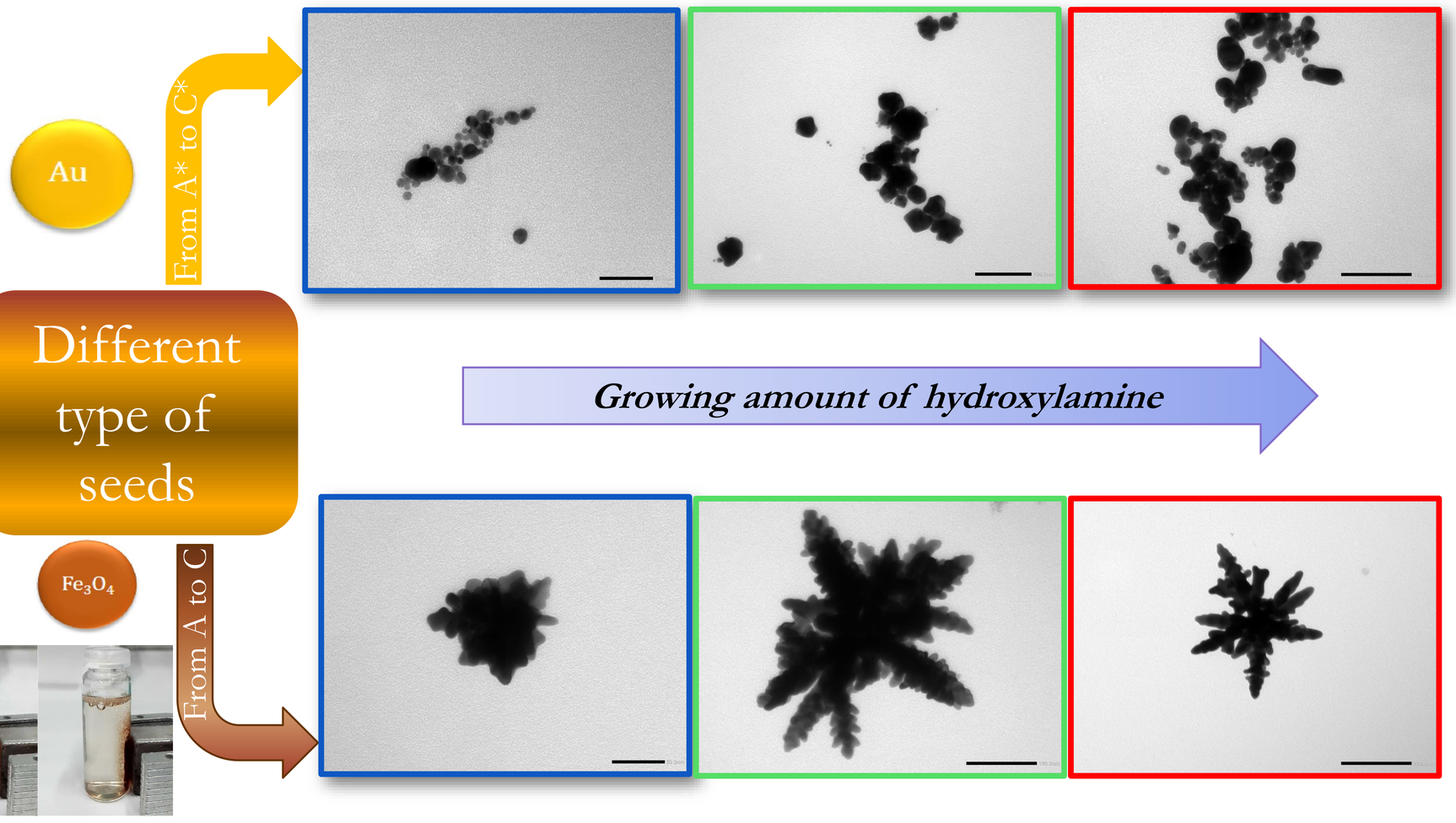
The gold germination and growth is correlated to the role of hydroxylamine used as surface-catalysed reducing agent on two different seeds: iron oxide (A,B,C)and gold (A*,B*,C*).

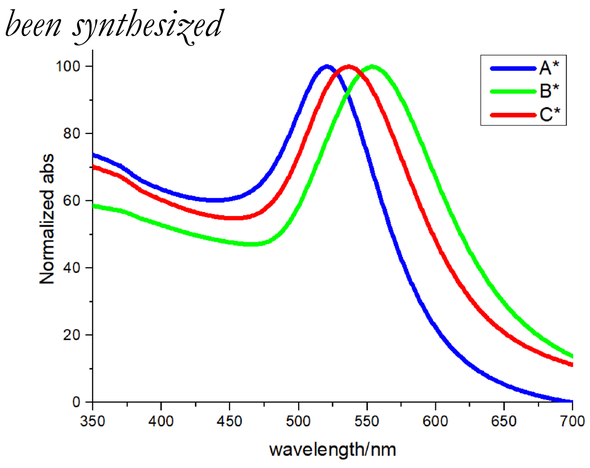


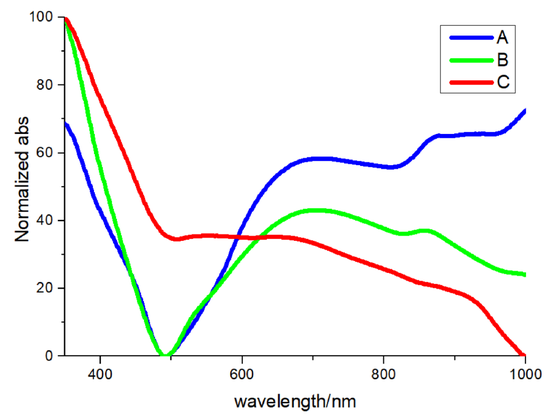
Hybrid nanoparticles, composed of an iron oxide magnetic core embedded with gold fractal-grown hyper branches, have been synthesized by seed mediated growth approach. ***Magnetic and plasmonic properties*** were ascertained and according to the ***hydroxylamine amount***, used as surface-catalysed reducing agent, the number of branches and the intensity of the fractal growth have been both finely tuned. The ***superparamagnetic core*** allows their motion control via an ***external magnetic field***. The ***plasmonic properties*** of these hyper branched hybrid nanoparticles are similar to the ones display by ***gold branched nanoparticles***, but interestingly, they are characterised by a better ***photothermal response***.

*The seed solution has been added to an aqueous solution of sodium citrate, followed by addition of tetrachloroauric acid. The Au^{3+} ions were promptly reduced to Au^0 by the addition of various amount of hydroxylamine that induces the reduction of gold ions on the surface of two different seeds: gold (A*B*C*) and iron oxide (A B C **hybrid nanoparticles**)…….*

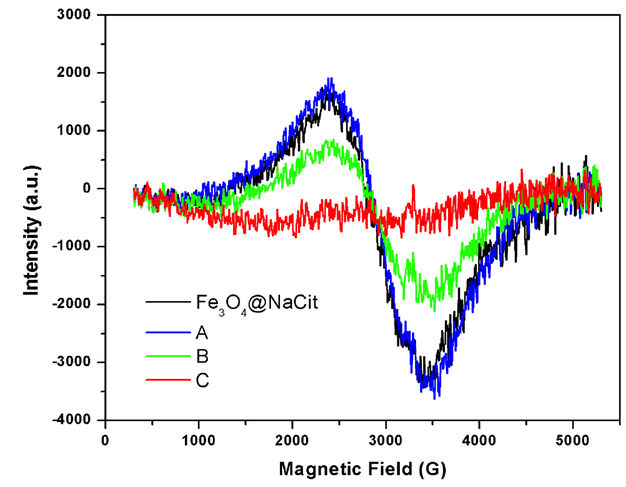
….as the hydroxylamine amount increases, the quantity of gold deposited onto the iron seeds increases as well and different nanoparticles have been synthesized







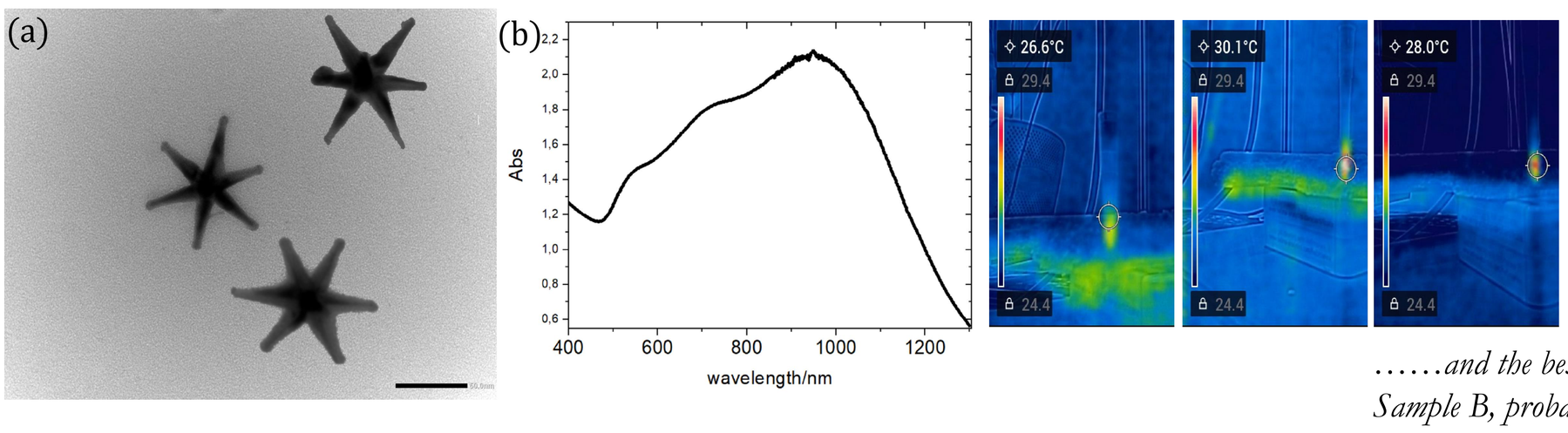
……Hybrid nanoparticles display EPR spectra whose intensity is dependent on gold content



……and the best response is attributable to Sample B, probably for the local amplification of the plasmonic electromagnetic field located at the

Homometallic Gold branched nanoparticles and photothermal activity comparison

*In order to test the importance of the hyper branched shape of the nanoparticles in the photothermal activity we have been synthesized and characterized **homometallic branched gold nanoparticles**……..*



Gold branched nanoparticles: TEM image (a) and the extinction spectrum (b)

A new synthetic strategy has been proposed to obtain ***hybrid nanoparticles*** with ***iron oxide magnetic core and gold fractal growth hyper branches***. The gold germination and growth is studied and correlated to the ***role of hydroxylamine*** used as surface-catalysed reducing agent on ***two different seeds***, specifically ***iron oxide and gold***. The Iron/gold hybrid nanoparticles, sensitive to ***magnetic field***, show ***plasmonic properties*** in visible and NIR region. Furthermore, a stronger ***photothermal effect*** is recorded in the hybrid hyper branched nanoparticles compared with ***homometallic gold branched*** counterparts. The optical and magnetic behaviour makes possible to forecast these nanoparticles as interesting tools in various application fields such as biotechnological and biomedical. Combining photothermal and hyperthermal activities they can be employed in heating treatment. Moreover, they can be used as magnetically piloted deliver of photoactive molecules.

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