

Integration of gold nanoparticles in photonic crystals: effect of the interplay between plasmonic and optical cavity resonances

Alberto Jiménez-Solano¹, Carmen López-López¹, Olalla Sánchez-Sobrado¹, José Miguel Luque¹, Mauricio E. Calvo¹, Cristina Fernández-López², Ana Sánchez-Iglesias², Luis M. Liz-Marzán² and Hernán Míguez²

¹Instituto de Ciencia de Materiales de Sevilla, CSIC-Universidad de Sevilla, Sevilla, Spain

²Departamento de Química Física, Universidad de Vigo, 36310 Vigo, Spain

alberto.jimenez@csic.es

Herein we show experimental examples of localized photon modes in periodical multilayer structures. [1,2] These experiments show the control of the spectral modification of the optical absorption of one-dimensional photonic crystal based resonators containing different types of gold nanoparticles. This control was achieved through the changes in the photonic environment of the gold nanoparticles by means of the interplay between planar optical cavity modes and localized surface plasmons [3].

Spin-casting of metal oxide nanoparticle suspensions was used to build multilayered photonic structures that host (silica-coated) gold nanorods and spheres (Figure 1). Strong reinforcement and depletion of the absorbance was observed at designed wavelength ranges, thus proving that our method provides a reliable means to modify the optical absorption originated at plasmonic resonances of particles of arbitrary shape and within a wide range of sizes. [4] Results are explained in terms of the calculated spatial distribution of the electric field intensity within the configurations under analysis.

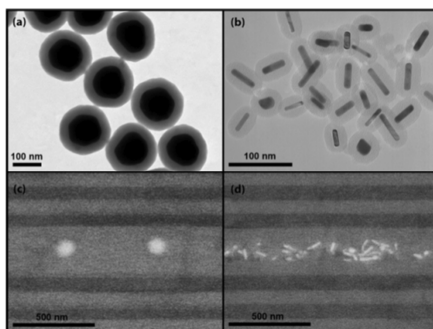


Figure 1: Top: TEM images of Au@SiO₂ nanospheres (a) and rods (b). Bottom: SEM backscattered electrons images of cross sections of optical resonators hosting Au@SiO₂ nanospheres (c) and rods (d).

References

- [1] Calvo, M.E., Colodrero, S., Rojas, T.C., Anta, J.A., Ocaña, M. and Míguez, H. *Adv. Func. Mater.* 18 (2008) 2708-2715.
- [2] Colodrero, S., Ocaña, M. and Míguez, H. *Langmuir* 24 (2008) 4430-4434.
- [3] Sánchez-Sobrado, O., Lozano, G., Calvo, M.E., Sánchez-Iglesias, A., Liz-Marzán, L.M. and Míguez, H. *Adv. Mater.* 23 (2011) 2108-2112.
- [4] Jiménez-Solano, A., López-López, C., Sánchez-Sobrado, O., Luque, J.M., Calvo, M.E., Fernández-López, C., Sánchez-Iglesias, A., Liz-Marzán, L.M. and Míguez, H. *Langmuir* 28 (2012) 9161-9167.