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

Alberto Jiménez-Solano[1], Carmen López-López[1], Olalla Sánchez-Sobrado[1], José Miguel Luque[1], Mauricio E. Calvo[1], Cristina Fernández-López[2], Ana Sánchez-Iglesias[2], Luis M. Liz-Marzán[2] and Hernán Míguez[2]

[1]Instituto de Ciencia de Materiales de Sevilla, Consejo Superior de Investigaciones Científicas-Universidad de Sevilla, C/ Américo Vespucio 49, 41092 Sevilla, Spain
[2]Departamento de Química Física, Universidad de Vigo, 36310 Vigo, Spain

alberto.jimenez@csic.es

Abstract

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 plamons.

Spin-casting of metal oxide nanoparticle suspensions was used to build multilayered photonic structures [3] that host (silica-coated) gold nanorods and spheres (Figure 1). Strong reinforcement and depletion of the absorptance 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. Results are explained in terms of the calculated spatial distribution of the electric field intensity within the configurations under analysis.[4]

References

[1] Sánchez-Sobrado, O., Lozano, G., Calvo, M.E., Sánchez-Iglesias, A., Liz-Marzán, L.M. and Míguez, H. *Adv. Mater*. **23** (2011) 2108-2112.

[2] 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.

[3] Colodrero, S., Ocaña, M. and Míguez, H. *Langmuir* **24** (2008) 4430-4434.

[4] Anaya, M., Calvo, M.E., Luque-Raigón, J.M. And Míguez, H. *J. Am. Chem. Soc.* **135**, (2013) 7803-7806.

Figures

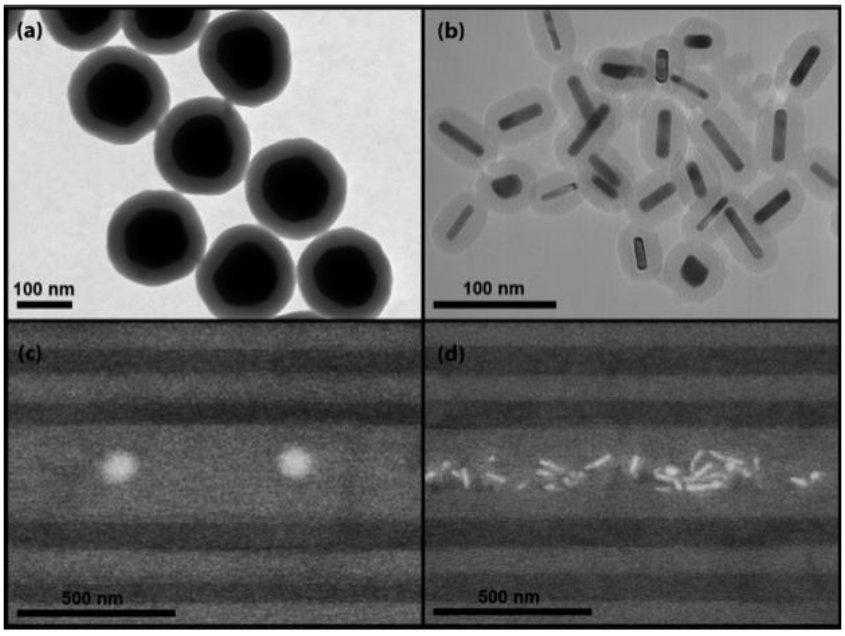

Figure 1. Top: TEM images of Au@SiO_2 nanospheres (a) and rods (b). Bottom: SEM backscattered electrons images of cross sections of optical resonators hosting Au@SiO_2 nanospheres (c) and rods (d).