Optical spectroscopy study of colloidal gold nanorods: model for thiolated nanorods

N. Zabala[1,2], F.J. Recio[3,4], L Bergamini[1,2], A. Ayuela[2], A. Rivacoba[2,5], P. Crespo[3], A. Hernando[3] and P.M. Echenique[2,5]

[1]Dept. Electricidad y Electrónica, FCT-ZTF, UPV-EHU, Bilbao, Spain
[2]Centro de Materiales CFM-MPC (CSIC-UPV/EHU) and DIPC, San Sebastian, Spain
[3]Instituto de Magnetismo Aplicado, UCM-CSIC-ADIF and Dept. Física de Materiales, UCM, Madrid, Spain
[4]Dept. Química de los Materiales, Univ. Santiago de Chile, Santiago, Chile
[5]Dept. Física de Materiales, UPV-EHU, San Sebastian, Spain
nerea.zabala@ehu.es

Abstract

We report results on the optical response of thin nanorods (NRs) produced with a seed-mediated growth method followed by a filtering process [1]. In this way, anisotropic gold NRs are obtained with different aspect ratios and lengths covering the range between tenths to a few hundred of nanometers. Because of our interest in medical applications, gold NRs are dispersed in colloidal solutions, so that some molecules are bound to their surfaces and keep them partially separated. We use well-known solvents: first a CTAB-water solution, where gold NRs of different sizes are grown from Au NP seeds, and then a thiolate solution. The short and long Au NRs are characterized using HRTEM and UV-Vis-NIR spectroscopy. The study focuses on the long NR samples (L >100nm) obtained after filtering. In particular, understanding the origin of a peak that appears about 960 nm for several solvents and its evolution with the Au NR colloidal concentrations is one of the main challenges concerning the characterization of their optical response (Figure 1). We perform this study with the help of full electrodynamical boundary element method (BEM) calculations. The incorporation of a dielectric model based on ab-initio calculations of thiolate-gold cluster surfaces allows us to explain the trends observed in the spectra recorded for the samples of NRs covered with thiolates.

References

[1] F.J. Recio, N. Zabala, A. Rivacoba, P. Crespo, A. Ayuela, P.M. Echenique and A. Hernando, J. Chem. Phys. C, to be published.

Figures

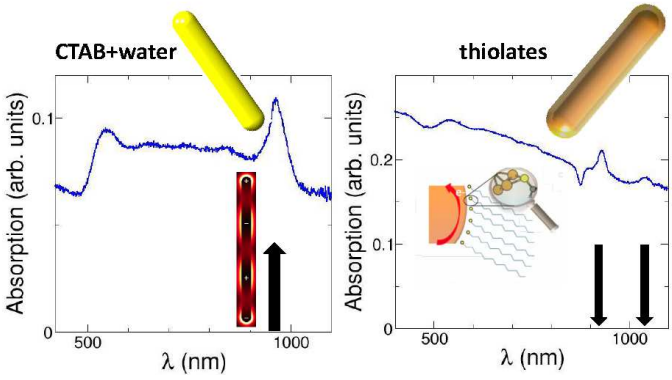

Figure 1: Absorption spectra of the long Au NR sample (average length L=390nm and width D=26nm) in aqueous CTAB solution (left) and in a thiolate solution (right).