TuPO48.189

Metal nanocolumns produced by pulsed laser deposited silver nanostructures

Jérémie Margueritat[1,2]*, Jose Gonzalo, and Carmen N. Afonso
[1]Instituto de Optica, CSIC, 121 Calle Serrano, 28006, Madrid, Spain

Adnen Mlayah
[2]Laboratoire de Physique des Solides de Toulouse, IRSAMC, Bât 3R1b2, 118 route de Narbonne, 31062 Toulouse Cedex 4, France

M. Isabel Ortiz, Carmen Ballesteros
LABMET UC3M, 30 Av. Universidad, 28911 Leganés, Madrid, Spain

Silver nanoparticles have for long been studied due to their optical properties. They are dominated by the absorption at the surface plasmon resonance (SPR) wavelength that, in the particular case of silver, is well separated from the interband transitions and thus the dependence of SPR on several features of the nanoparticles such as size or shape can be easily studied. For several optical applications, it is interesting to be able to tune the SPR to wavelengths of interest. The SPR depends not only on these nanoparticles features but also on the dielectric host in which the nanoparticles are embedded and their distribution in it. Further tuning can be achieved by producing complex nanoparticles and structures. Among the possible way for achieving a control of SPR wavelength or producing more than one SPR, the production of aligned nanocolumns has for some time been discussed as a promising route. The aim of this work is to explore the production of *"nanodesinged"* composites having such elongated metal nanoparticles or nanowires all aligned in the direction perpendicular to the substrate.

In earlier works, we have successfully used pulsed laser deposition (PLD) for embedding Ag nanoparticles in an amorphous Al_2O_3 host, the nanoparticles being organized in layers whose separation could easily be controlled. In this work, we have extended this technology to produce nanocolumns by reducing the distance between consecutive layers until each metal deposition interacts with the previous one. In this way, a wide range of metal nanostructures are expected ranging from electronically confined states 0D (nanoparticles) to 1D (nanocolumns) and 2D (nanolayers). The position of the SPR in the 0D configuration suggests that the particles are spherical with an average diameter around 2.6 nm. As the separation between layers is decreased, both the optical absorption and the Raman scattering spectra show strong spectral changes, a second maximum or a shoulder appearing in each spectrum respectively. The result are found consistent with the appearance of anisotropy along the direction of growth and with the transition from 0D to 1D and 2D structures as the separation between "layers" is significantly reduced.

*Presenting Author: j.margueritat@io.cfmac.csic.es; Telephone: (+34) 915 61 68 00 ext: 23 28; Fax: (+34) 915 64 55 57

Acknowledgments: this work has partially supported by the EU NanoCluster Network (HPRN-CT-2002-00328).