Poster

Tunable in plane optical anisotropy of Ag nanostructures growth on columnar SiO_2 template thin films

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Abstract

Metal nanoparticles (MNPs) have been the focus of many studies during the last decades because of their applications in optical devices, as sensors and in SERS.[1] The control of the MNPs shape, size and organization supported in solid substrates is synthetic priority objetive since these parameters control the spectral response of the material and its performance in a wide variety of applications.[2]. In fact, an active research has been carried out to grow 2D assemblies of elongated MNPs with a high aspect ratio and a parallel orientation (nanostripes) or parallel chains of MNPs with a strong optical anisotropy in the plane of the substrate (in-plane anisotropy) for the fabrication of dichroic filters, polarized light nanosources or materials showing high second-order non-linearities.[3-4] Among the different methods used to fabricate MNPs in a controlled way, the physical vapor deposition of metals onto substrates presenting a 1D periodic roughness has been reported to promote the growth of silver nanostripes or chains of silver nanoparticles oriented in the plane of the substrate.[5]

In this communication we present an easy and straightforward method for growing 2D assemblies of Ag nanostructures characterized by a tunable in-plane optical anisotropy. Ag NPs are deposited by DC sputtering in an Ar plasma at room temperature onto bundled nanocolumnar SiO_2 thin films grown by glancing angle physical vapor deposition (GAPVD). In contrast with previously reported processes involving the grazing angle deposition of the metal[6], DC sputtering is performed at normal incidence. The topology of the Ag deposit changes from isolated spherical Ag nanoparticles with isotropic optical properties to strongly dichroic Ag nanostripes oriented along the bundling direction of the SiO_2 nanocolumns. A simple model is proposed in order to explain the significant effect of the width and shape of the bundled SiO_2 nanocolumns tips on the metal local atom flux arriving to them and on the final structure of the metal/oxide composites. This model also evidences that one of the most important factors driving the formation of the Ag nanostripes is the shadowing effects during metal deposition.

References:

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Figures:

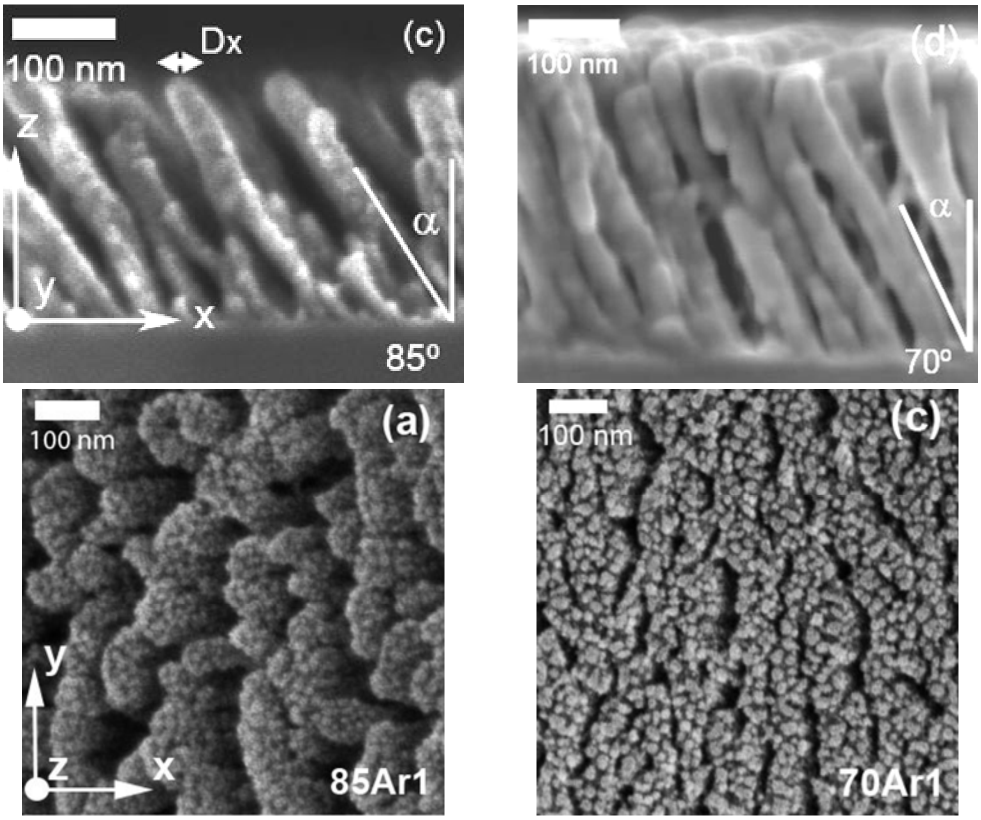

Figure. Top) Cross Sectional SEM micrographs of the SiO_2 columnar thin films grown at a 85º (left) and 70º (right) incidence angle.. Bottom) SEM plan-views micrographs of the SiO_2 surface after the deposition of silver for the thin films grown at a 85º (left) and 70º (right) incidence angle.