Nanorod-based plasmonic substrates with predefined optical resonances

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RESUMEN

To design and fabricate plasmonic substrates to be used in ultrasensitive chemical sensing or surfaceenhanced spectroscopies, it is important to achieve control on the morphology, dimensions and surface density of metallic nanostructures on the substrate, and therefore to achieve control on their optical resonances. In this direction, monodisperse colloidal gold nanorods were synthesized in a seed-mediated growth [1] with a longitudinal surface plasmon resonance tunable in wavelengths from 600 to 1000 nm. These nanorods with well-controlled size and aspect ratio were used as plasmonic building blocks. Glass substrates were chemically modified and the synthesized gold nanorods were adsorbed through a dipping process [2].

The nanostructured coverage dynamics of these substrates was characterized by spectrophotometry and electron microscopy (Fig. 1). A nanoparticle surface aggregation was observed during the coverage process at long times. This aggregation is dominated by the mobility of the isolated nanorods, which first join in dimers and, further in time, in clusters of higher number of nanorods, changing from well-defined longitudinal plasmons to more complex coupling resonances. Evolution of amplitudes of resonance peaks in extinction spectra and nanorod counting statistics were used to model both coverage and aggregation processes [3]. Their characteristic times and saturation values were analyzed and related with kinetic parameters and nanorod extinction coefficients. This work can be used as a predictive tool to prepare plasmonic substrates with desired optical resonances.

Key words: UTN; FRD; Plasmonic substrates; metallic nanostructures