Characterization of Noble Metal Functionalized Nanoparticles Based Networks by Photoacoustic Spectroscopy

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Functionalized metal nanoparticles are transforming many research fields, from biomedicine to catalysis and energy conversion with the intellectual excitement associated with the chance of finding new materials with synergic properties. The large surface area of MNPs leads to high local concentrations of ligands on the surface, providing enhanced opportunities for drug delivery [1]. Additionally, MNPs can be functionalized with optically active organic or organometallic molecules and the optical/electronic properties of the metallic core can be tuned together with the optical behavior of the ligands [2]. Moreover, the easy manipulation of colloidal MNPs allows their self-assembly into complex structures, 2D or 3D networks that show collective properties. A fundamental role in properties and potential applications is played by the functionalizing ligand; for example, organic thiols, [3] organometallic systems [4] or polymers [5] can make NP-based colloids easily handy in organic or aqueous media. In this paper silver nanoparticles (AgNPs-FL) functionalized with the π-conjugated dithiol, 9,9-didodecyl-2,7-bis-thiofluorene (FL) have been studied by means of spectroscopic and morphological techniques. For the characterization of the AgNPs-FL we have applied photoacoustic spectroscopy (PAS) which is a suitable technique for the optical and thermal analysis of scattering materials giving complementary information to optical transmittance [6,7]. In particular, we applied the PAS technique in the UV/VIS range from 300 to 600 nm to investigate the changes of the light diffusion and absorption across the plasmonic resonances for a solution of AgNPs in chloroform. PAS confirms to be the most appropriate technique to determine separately the absorption and scattering coefficients. From their ratio, one eventually obtains information on the size of the cluster of nanospheres bridged by the ligands, that in our case has been calculated at about 100 nm as also validated by TEM images.

References:

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