O.39 – Investigations on Polymer-Coated Gold Nanoparticles with Scattering-type Scanning Near-field Optical Microscopy

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Gold nanoparticles (Au NPs) represent one of the most popular types of nanomaterials as they are stable, easy to synthesize in various shapes and sizes with reproducible procedures and, well bio-compatible when delivered for therapeutic purposes[1]. As polymers are also highly tailorable and widely used in many biomedical topics, using them in combination with Au NPs significantly augments the number of applications of both materials classes, together with their efficiency. For example, polymeric coatings can offer various mechanical properties to the Au NPs, which can favour or obstruct their internalization in cells, whereas the plasmonic properties of the Au-NPs can be used to tune the optical properties of fluorophore doped polymer shells. The interplay between the Au core and the polymer coating can be exploited in many other ways, being generally considered a very important chemical engineering tool[2]. In this work we investigate polymer coated Au-NPs with scattering-type Scanning Near-Field Optical Microscopy (s-SNOM), an emerging optical characterization technique capable to provide optical information at nanoscale resolution[3]. s-SNOM amplitude and phase images were acquired in the visible frequency range, under illumination with 532nm, a wavelength falling in the absorption band of the investigated instances made of an Au core covered by composite polymeric shells, consisting of polystyrene sulfonate (PSS) and poly(diallyldimethylammonium chloride) (PDDA), of different thicknesses.
In this configuration, with a Co-Cr tip, we obtain strong phase contrast for the bare and shallow coated Au-NPs, whereas the polymer coating seems to attenuate the phase contrast in the case of thick-shell instances. We discuss as well imaging results obtained with an Au-coated tip, and with the initial Co-Cr one under illumination with an off-resonance wavelength, 1550nm, none of these two configurations being capable to provide similar s-SNOM phase contrast as observed in the case of the Co-Cr tip illuminated with 532nm. These observations can facilitate studies and applications in nanomedicine and nanotechnology where the precise positioning of AuNPs with nanoscale resolution is needed. Such applications can also benefit of other opportunities offered by s-SNOM, such as quantitative dielectric function mapping[4]. Additionally, the results presented here can be relevant for other NPs comprised of different polymeric-shell metallic core combinations.

Keywords
scattering-type scanning near-field optical microscopy; polymer coated Au nanoparticles; optical nanoscopy

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