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Self-Assembled Monolayers on glass surfaces for anchoring metal nanoparticles and metal complexes

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Molecular self assembled monolayers (SAM) can be formed on SiO_2 surfaces thanks to the reaction of molecules of the $(RO)_3Si$---X and Cl_3Si---X type, with easy wet syntheses. Superficial –X groups on the SAM can easily react with molecules bearing suitable –Y groups through high yield chemical coupling reactions.[1] Thiol terminated monolayers are also capable of firmly anchoring metal (gold, silver, copper) nanoparticles, which are of great interest in developing specific surface activities when facing biological agents. As a first step we focused our attention on the thiol-maleimide reaction to evaluate the efficiency of the silanization process: by coupling a thiol terminated SAM with a strong chromophore (tetramethylrhodamine) bearing a maleimidic group, we estimated the surface concentration of thiol groups by means of UV-Vis spectroscopy. Morphology and physico-chemical properties of the obtained SAMs were also explored in detail through a full set of characterization techniques: Atomic Force Microscopy, spectroscopic FTIR-ATR and ellipsometry, fluorescence emission spectra, contact angle measurement.[2,3] Having set-up a highly efficient protocol for surface functionalization with a –SH terminated SAM, we are now working on different directions: the growth of functional monolayers exploiting straight-forward "click-like" chemical couplings to obtain covalently grafted SAM of transition metal complexes, and the deposition of SAMs of silver and copper nanoparticles. Combining multidisciplinary competences, a good chemical toolset and comprehensive surface characterization techniques we are ready to carry out surface modifications on several substrates (glass, quartz, SiO_2/Si) and to exploit the obtained functional materials in different research fields such as materials science, sensing, and medicinal chemistry.

References

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