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NANOSCALE HYBRID OBJECTS: A SMART COMBINATION OF CHEMISTRY AND SANS

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Nanohybrid objects based on polymer and inorganic nanoparticles are of great interest for different reasons. Indeed, the polymer part can help first for the stability and the organization of the particles, second to increase the amount of chemical functions available in the organic corona and finally to improve or to mask the properties of the particles. SANS is a well-suited technique for the study of these objects particularly due to the possibility to use contrast matching to see either the particle or the polymer corona. Here we are interested in the synthesis of platinum nanoparticles grafted with polymers and/or biological molecules which may be used as probes for biological detection. Indeed, the combination of the catalytic properties of the platinum with the functionalities of the polymer makes these objects particularly attractive for this type of application.

The method to introduce the polymer consists in using both the “grafting from” technique and controlled radical polymerisation. These systems are exempt of free polymers so the characterization via SANS can lead to quantitative data such as the amount of chains in the polymer corona and the chains molecular weight. Contrast matching has been used to see only the polymer chains. In both cases, polymerization kinetics was followed by SANS and the polymer corona spectra show a plateau at small q which attests that the objects are individual and well-dispersed. We used different models to fit the form factor: corona or polymer star (chains connected together to a very small core) depending on the system. From these models, we can determine both the number of chains, the radius of gyration of the polymer corona and the chains molecular weight. Results obtained from SANS have been compared to other techniques such as NMR or TEM measurements. A good correlation has also been observed with the compression isotherms of Langmuir films obtained directly from the polymer-grafted nanoparticles. The next step is the characterization of the grafting of the proteins via activated ester based reaction.

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