Physico-chemical analysis of Nanomaterials: It is all about surfaces!

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Nanomaterials are considered one of the most important advanced of the last years in the field of materials science. For instance, gold nanoparticles have been deeply investigated due to their peculiar properties making them attractive as (bio)sensors.[1] Moreover, carbon-based nanomaterials, such as graphene and fullerenes, together with other organic and inorganic nanoparticles (e.g. liposomes, polymeric nanodroplets, metal oxides and quantum dots) are strongly investigated because of their potential applications in different fields. [2,]

In almost all cases, and in particular in (bio)applications, the use of nanomaterials requires the development of surface functionalization protocols. For instance, in the case of gold nanoparticles, the use of Self Assembled Monolayers (SAMs) to tailor the surface properties has become a paramount process in almost all applications.[1] On the other hands, carbon based nanomaterials needs to be functionalized in order to be suspended in water based solvents. [3]

Despite the great progresses achieved in the last years, several issues are still to be solved encompassing design, stability, potential toxicity and environmental effects of nanomaterials.[4] Moreover, a robust and detailed physico-chemical characterisation of the surface functionalization processes is still lacking in many studies and a systematic and reproducible usage of the surface analysis techniques is not yet considered as a common “to do” step in the nanomaterials community.[5]

In this presentation, I will review some of main issue related to the application of surface analysis techniques such as XPS and ToF-SIMS to nanomaterials by illustrating different examples regarding the characterisation of inorganic nanoparticles including gold, carbon-based nanomaterials and oxides.

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