

Functionalization of Carbon Nanostructures with Inorganic Nanoparticles

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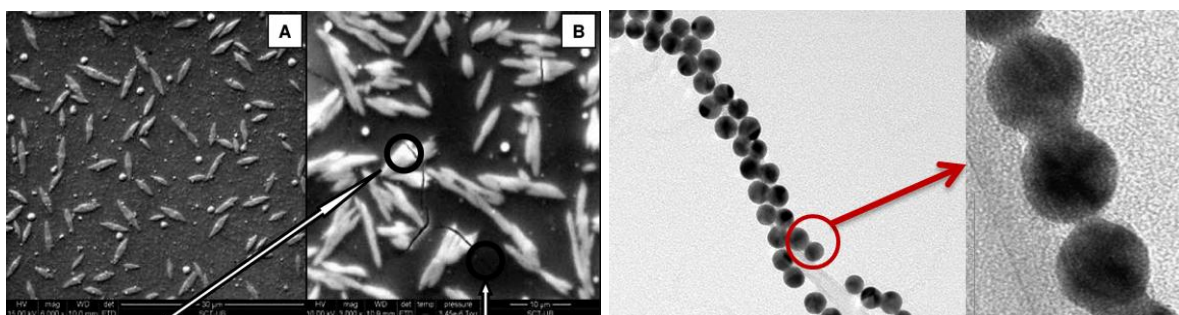
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Inorganic nanoparticles (NPs) have emerged as a new class of materials particularly interesting due to their unique size and shape-dependent electronic, optical, magnetic and catalytical properties. On the other hand, carbon nanostructures (CNS) presents a high surface area, high thermal and electrical conductivity and chemical inertness. On this regard, the combination of these two components in an hybrid nanostructure (HNS) may lead to a new class of functional materials that integrate the properties of both components. These HNS present important features for catalysis, nanotechnology and materials science applications [1] while electronic communication between both structures open new frontiers in the design of photoelectronic or light-energy conversion devices. Additionally, CNS can be used as a scaffolds to build 1D or 2D self-assembled nanowires or nanosheets of inorganic NPs.

The most important and crucial point for the future expansion of these new class of materials for technological applications is to find powerful synthetic methodologies to produce HNS with reproducible properties and performances. Up to date, all used methods are either based on the direct growth of NPs onto CNS or the attachment of pre-synthesized NPs to CNSs via their covalent linking through organic molecules. While the direct growth is usually a simple and effective synthetic method, it does not allow the easy control of the final NPs morphology. Alternatively, the attachment of pre-formed NPs to CNT leads to better size and shape selection, although it involves a multi-reaction process in order to modify the inert facets of the CNS. In this context, we developed a protocol for the functionalization of CNS with inorganic NPs based on the use of CNS as ligands. Under the appropriate conditions, this method allows i) the destabilization of the original surfactant layer of the NP and ii) the further use of CNS facets as additional ligands. This technique leads to CNS selectively decorated with metal NPs, avoiding tedious surface modification[2-4].



Functionalization of CNS with Inorganic Nanoparticles: (Left) Co-CNS hybrid nanostructures (4-8 μm Co rice-grain like structures). **(Right)** Au-CNT HNCs dispersed in toluene (Au NPs are 12 nm in diameter).

References:

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