Engineering of Interfaces for Preparing new Functional Materials

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Nanostructure science and technology are a broad and interdisciplinary area of research and development that has been exponentially growing in the past few years. Engineered nanomaterials are resources designed at the molecular (nanometer) scale to take advantage of their small size and novel properties which are generally not seen in their conventional bulk counterparts. The two main reasons why nanomaterials can have different properties are: (i) the increase of relative surface area and (ii) the quantum confinement effects leading to novel optical, electrical and magnetic behaviors. In order to apply these nanomaterials in different fields and to increase the throughput of nanostructured materials and devices for energy, environmental and health applications, an efficient engineering of the nanomaterials interfaces is needed.

Here, we used different synthesis techniques such as atomic layer deposition (ALD),[1] electrospinning, electrodeposition, anodisation, nanospheres lithography, 3D printing and the exfoliation of Graphene and BN like Graphene etc. as the main tools for the creation of controlled nanostructured materials and interfaces [2] in which the geometry can be tuned accurately and the dependence of the physical-chemical properties on the geometric parameters can be studied systematically in order to investigate their performances in energy, environmental and health applications. We will show examples of how these methods can be used to create (bio)- fuel cells, [3] single nanopores for sensing and sequencing, [4] membrane for gas purification, osmotic energy harvesting and water treatment, optical sensors and biosensors [5], and bionanocomposites materials for packaging [6], drug delivery [7] and tissue engineering in which the performance varies with the nanostructures/interfaces.

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Figures

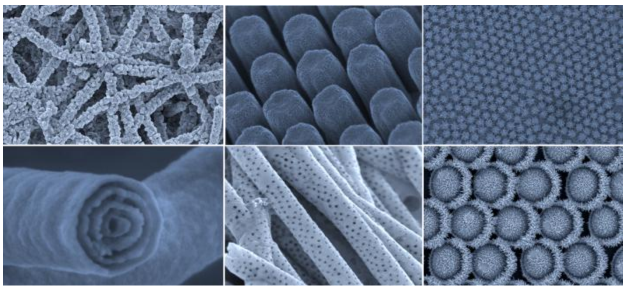

Figure 1. Design of bionanostructures materials for energy, environmental and health applications