

Development of hybrid nanostructured thin films with the Langmuir-Blodgett technique

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In this dissertation a new bottom-up approach for the production of two-dimensional organo-modified hybrid materials where layered materials (smectite clays, graphene oxide and layered double hydroxides) act as the structure directing interface and reaction media is discussed. This new method, based on combining self-assembly with the Langmuir-Schaefer technique, uses the layered nanosheets as a template for the grafting of guest molecules (organic surfactants like DODA, ODA, stearic acid etc) in a bi-dimensional array, and allows for perfect layer-by-layer growth with control at the molecular level. The resulted hybrid organophilic layered structures were characterized by a combination of analytical techniques including powder X-ray diffraction, Raman and FTIR spectroscopies, thermal analysis (DTA/TGA) as well as Atomic Force Microscopy. The experiments gave an insight into the formation process, structural details and properties of the final hybrid structures. The described fabrication routes allow one to create entirely novel architectures whose final structure is encoded in the shape and properties of the clusters or molecules that are used. Finally, the same technique was used for the effective isolation and morphological characterization of various carbon nanostructures such as modified carbon dots and carbon nanotube-fullerol hybrids that is very difficult to separate (in solid state) due to their strong tendency to aggregate.
