Recent developments on functional nanoarchitectures based on clay silicates: from supported graphenes to bionanocomposites

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Abstract

The synthesis of nanoarchitectures based on silica and silicates belonging to the clay family, is an achievement emerged in recent years that procures functional materials of interest in various advanced applications [1]. Layered and fibrous clays, i.e. smectites and sepiolite, can be regarded as extremely versatile silicates presented as nanosized solids with structural and textural features that allow their assembling as building units with diverse organic or inorganic components. Bottom-up approaches involving diverse type of clay particles and components of different origin able to introduce a modulated functionality have been used for that assembly [2]. In this way alkoxides, nanoparticles and biopolymers are typical examples of those components able to give rise to complex nanostructured systems as diverse as magnetic nanoplatforms, ultra light-weigh monolits, selective heterogeneous catalysts or active phases of chemical sensors.

This communication will illustrate several examples of clay-based nanoarchitectures. The first one will focus on the preparation of conductive **supported graphenes** from natural resources, such as sucrose or gelatin, used as precursors in this *green way* synthetic approach of graphenes [3]. The resulting carbon-clay nanocomposite materials exhibit electrical conductivity, inherent to the *in situ* synthesized graphenes, together with the properties of the clay silicate [*e.g.*, ion-exchange ability; elevated porosity & specific surface area] which allow their applications as components of electrochemical devices (supercapacitors, lithium-batteries and ion-sensors). The second example will introduce **superparamagnetic adsorbents** prepared by infiltration of clays with ferrofluids based on magnetite nanoparticles that lead to nanostructured materials of interest for the easy uptake of pollutants in water, including pesticides and radionuclides [4]. The third example will describe inorganic-organic **biohybrid systems** consisting of layered or fibrous clay particles assembled to biopolymers and other components of biological origin [5,6]. These biohybrids represent an interphase between living bodies and inorganic silicates that may give rise to materials provided of bioactivity introduced by the incorporated bio-components.

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References

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