Séminaire de Sylvie BEGIN-COLIN

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Salle 4-A014, Institut Jean Lamour, Campus Artem

Engineering of iron oxide and carbon based nanocomposites for energy and environmental applications.

Iron oxide nanoparticles (NPs) are used in a broad range of applications from nanoelectronics to energy and biomedical fields. However, these applications require the design of specific iron oxide nanostructures with properties adapted to the targeted applications. Indeed, in the energy sector, the expansion of the battery and supercondensator market and ever-increasing demands in terms of cyclability, cost and performance mean that new electrode materials need to be developed to meet these needs. Iron oxide nanomaterials are among the most promising of these materials, and are currently very popular due to their cost, abundance and, above all, their ability to store large quantities of lithium ions. However, these metal oxides have two major shortcomings: their mechanical strength during cycling, and their low electrical conductivity. We have thus designed porous and hollow iron oxide nanostructures combined with few layer graphen and build electrodes by a Layer by Layer strategy.
Such original nancomposites (NCs) have also been optimized for environnemental applications. Indeed, there is a wide range of pollutants present in different environmental media that can be harmful to human health and the environment, such as polycyclic aromatic hydrocarbons (PAHs). PAHs are widespread persistent environmental pollutants, with significant health risks: they are toxic, mutagenic, carcinogenic and endocrine disruptors. Thus, monitoring their presence and removing them from the environment is essential, but it remains a challenge. The previous NCs couple the adsorption efficiency of graphene with the easy magnetic separation of magnetic nanomaterials and are thus promising for the removal of PAHs from water. One key step is their colloidal stability in water, which has been optimized by introducing a surfactant. Very good removal efficiencies were also obtained with individual and complex mixtures of PAHs and even a selectivity was noticed, confirming the potential of the NCs for PAH removal from the environment. In addition, the NCs were successfully loaded into different supports making it possible to use them in water or air filtration devices for depollution practices or chemical analysis.
Such approaches to the chemical design, aimed at adapting nanomaterials to their intended applications, are of major importance for the industrial development of these materials.

Séminaire organisé par le Département Chimie et physique des surfaces et des solides