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Molecularly designed architectures: A route towards applications of graphene

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Graphene is an exciting material with a huge potential for the development of new advanced technologies. The unique combination of properties, such as high specific surface area, chemical stability, mechanical strength, flexibility, high electrical and thermal conductivity, tunable band gap, and optical transparency makes graphene the ideal material for the development of a number of applications including intelligent coatings, inks, reinforced composites, biomedical devices, and environmentally friendly materials. Unfortunately, for applicability, several problems arise, including scalability, dispersibility and stability. Another challenging issue is related to the chemical nature of graphene sheets and their reactivity. Several authors have proposed chemical functionalization as a feasible solution to render graphene dispersible in many solvents and readily for its integration in different matrixes. In order to exploit the high mobility present in graphene, the band gap can be engineered and controlled by doping semimetal graphene through chemical modifications. Furthermore, by performing chemical organic reactions, it is possible to exactly tune the interfacial properties of graphene for increase its compatibility and integration in functional composites. In this work, I will describe our recent efforts on the chemical functionalization of graphene towards applications. This approach could lead to new materials with well-defined molecular properties on high quality graphene. The tailored chemical design of graphene platforms is essential for the development of new exciting functional materials.