

Functionalization of synthetic carbon allotropes

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Chemical functionalization of new C-allotropes is of fundamental interest and opens the door to unprecedented materials applications. In principle, the physical and chemical properties of fullerenes, carbon nanotubes (CNTs) and graphene are related to each other, although their levels of development vary considerably. In order to efficiently explore the reactivity of the less developed CNTs and especially that of graphene it is our goal to provide a unifying approach for the chemistry of all three new carbon allotropes. The fullerenes present the first family of synthetic carbon allotropes. Since their availability in macroscopic quantities numerous investigations with respect to their physical characterization and chemical functionalization have been carried out. CNTs - the second new family of C-allotropes - exhibit at least the same potential for unprecedented applications. Their chemistry, however, is much less developed. Although many protocols for covalent and non-covalent CNT functionalization have been published there are still many fundamental problems to be solved. This includes *inter alia* the highly selective functionalization of metallic- or semiconducting SWNTs, the high throughput isolation of SWNTs with single helicity, the development of general concepts allowing for tunable doping of individualized tubes with single helicity or least defined transport characteristics (metallic – semiconductive). Finally, the youngest representative in the list of new C-allotropes is graphene and the exploration of its chemistry has just begun to start. So far only investigation on the functionalization of defect rich graphene oxide (GO) but not intact graphene itself have been published. Compared to the various flavours of CNTs (broad variation of helicities, single walled, multi walled) graphene is a much more uniform material. This will facilitate the development of its chemistry considerably. We will present a series of new results of covalent and non-covalent functionalizations of fullerenes, carbon nanotubes and graphene.