Supramolecular approaches to 2-D materials:
from complex structures to sophisticated functions

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Abstract
Supramolecularly engineered hybrid materials containing graphene are key multifunctional systems for applications in (opto)electronics and energy. The tuning of their dynamic physical and chemical properties can be achieved via tailored covalent or non-covalent interactions with ad-hoc macromolecules.[1] My lecture will review our recent findings on:
(i) The harnessing of the yield of exfoliation of graphene in liquid media by mastering the supramolecular approach via the combination with suitably designed functional molecules possessing high affinity for the graphene surface, leading ultimately to the bottom-up formation of optically responsive graphene based nanocomposites for electronics. [2]
(ii) The tuning of the graphene properties by combining them with organic semiconductors as a strategy both to promote hole mobility in an otherwise electron transporting material and to exploit the tunable ionization energy of thermally annealed liquid phase exfoliated graphene to modulate the transport regime as well as to fabricate new memory devices.[3]
(iii) The bottom-up formation of graphene based 3D covalent frameworks with tunable intersheet distance, exhibiting large specific surface areas which determine extremely high performance in supercapacitors.[4]
(iv) The local thermal reduction of graphene oxide using a laser writer in order to develop very smooth, ultra thin, highly transparent and extremely conducting reduced graphene oxide patterns that can operate as highly sensitive ozone sensor.
Our approaches provide a glimpse on the chemist's toolbox to generate multifunctional graphene based nanocomposites with ad-hoc properties to address societal needs in electronics and energy applications.

References

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