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Recent Developments in the Chemistry of Graphene and Other 2D Materials

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The chemistry of 2D materials (2DMs) offers several advantages:
1) Improved solubility and easier handling of otherwise "difficult" materials;
2) Additional functions can be implanted on the 2DMs, such as chromophores, electroactive units, drugs, etc.;
3) Potential toxicity of the 2DMs can be at least partially lifted by organic functionalization, thanks to improved solubility and de-aggregation in physiological media.
However, usually, 2DMs are unreactive chemical species. In order to force the reactivity of 2DMs, either we need to employ particularly harsch conditions or we need to activate the substrate towards additions.
During this talk, we will present the various approaches to graphene functionalization and will also analyze other important challenges in graphene chemistry, such as the lack of standardization in the production of the graphene family members. Control of lateral size, aggregation state (single *vs.* few layers) and oxidation state (unmodified graphene *vs.* oxidized graphenes) is essential for the translation of this material into standardized applications. We will also address the toxicological impact and the limitations in translating graphene into advanced materials.
We will also discuss how exfoliated MoS_2 shows significant surface enhanced Raman scattering (SERS) activity towards specific dyes with low detection limits. The versatility of this approach allows the covalent functionalization of MoS_2 without relying on edge or basal-plane defects of the structure. This effective process is very useful for the preparation and functionalization of metallic TMD materials for further SERS applications.
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