The Importance of Graphene's Structure for Thermal Properties

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The thermal conductivity of graphene has shown record values in the case of micromechanically exfoliated suspended flakes. However, when the graphene is supported on a substrate this thermal conductivity decreases. Furthermore, if the sp2 lattice structure of graphene is modified to obtain chemically functionalized graphene (graphene oxide) the thermal conductivity decreases even further [1]. We investigated the impact of this sp2 structure on the thermal properties of graphene materials and we discovered that the presence of disorder within the lattice hindered the phonon transport while the electrical transport was less dramatically affected. Free standing graphene oxide films were subjected to different high temperature treatments and the evolution of the thermal conductivity was studied. The in-plane thermal conductivity increased with increasing annealing temperature while the crossplane thermal conductivity showed an opposite effect. This strong heat conduction anisotropy could be useful for applications in thermal management.

In addition, this type of functionalized graphene materials could be suitable to improve other properties such as electrical, mechanical and tribological of ceramic matrices [2,3] or even in very different fields such as in biomedical applications [4,5]. However, we should keep in mind that there is a very complex relationship between application-material type-property that is extremely important to match exactly in order to have the right material in the right application.

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