Experimental study and development of CVD processes for graphene growth on bulk polycrystalline and single Cu crystals

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2D materials are the subject of numerous studies today, both because of the variety of materials that can now be synthesised and then transferred onto substrates of interest, and also for the specific new functionalities that can be induced. The emergence process of dislocations at the interface between a 2D material and its host substrate during a plastic deformation of the latter (spontaneous or not),[1] has attached strong attention due to the direct effect on the final mechanical properties, especially on the coating materials. The understanding, identification and even the control over the origin of particular morphological structures (wrinkles or buckling) on the interacting sheet could, for instance, contribute to the development of separation techniques of 2D sheets from their catalytic growth support.

Here, we are focused on graphene, which is known to form a stable, continuous and gas-impermeable membrane, including in its ultimate monolayer form. Firstly, we are developing high quality graphene monolayers by chemical vapour deposition (CVD) on bulk single crystal and polycrystalline copper substrates, unlike the standardised copper foil substrates typically used on this process. The control over the crystallinity, grain size and the number of graphene layers is investigated following different growth protocols. Also, the quality of graphene is checked ex-situ by various analytical techniques (SEM, Raman spectroscopy and AFM). Then, the samples developed will be used to study the behaviour and mechanical stability of graphene under local mechanical stresses at nanoscale level by using ultra-high vacuum scanning tunneling microscopy thanks to a specialised tool (Nanoplast equipment [2]) designed to this aim.

References

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