Fonda Fasella Award

A link between corrugation and thermal stability of epitaxial graphene

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In recent years, epitaxial graphene has been the subject of an increasing interest in the fields of nanotechnology due to its outstanding properties.
It is acknowledged that the strength of the graphene-substrate coupling and the ensuing corrugation of the carbon film deeply affect not only the electronic, chemical and geometrical properties of the carbon layer, but also its heat transport properties.
In the present work we introduce a novel approach, based on the combined use of state-of-the-art synchrotron radiation-based techniques and density-functional theory calculations, to investigate the relationship between the corrugation of single-layer epitaxial graphene and its thermal stability. To this purpose, graphene was grown by chemical vapour deposition for the first time on a Re(0001) single crystal. As proved by our results, the strongly interacting nature of this system is reflected in a large corrugation of the graphene film on the substrate, and is responsible for its high temperature thermal instability. In fact, the disruption of the carbon network observed at high temperature turns out to be more likely in the buckled, strongly interacting regions of the moirè cell, although the process requires the presence of diffusing graphene layer vacancies.