Topological defect boundaries in graphene nanoislands

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Understanding grain boundaries in polycrystalline graphene is crucial for the control of both their electronic and mechanical properties. Depending on the topological structure of the boundary, this can impede transport across grains, or host their own one dimensional metallic states [1]. Concerning mechanical stability, it can either weaken or strengthen the graphene sheet [2].

We here report experimental evidence on some predicted and other new topological defect boundary structures, as found by Scanning Tunnelling Microscopy (STM) in graphene nanoislands grown on Ni(111) by CVD. By using mild annealing temperatures, we obtain multidomain nanoislands with different type of domain boundaries. High-resolution STM images allow us to characterize both the stacking and orientation of graphene domains and the boundary atomic structure. From a statistical analysis of the rotated domains, we conclude that their abundance is closely related to the boundary energetics [3], evidencing that the selection of rotational domains is determined by boundary rather than stacking energetics. The ring boundaries are particularly interesting since, according to previous calculations, they would confine graphene quantum dots with perfectly reflecting barriers [4].

References

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Figures

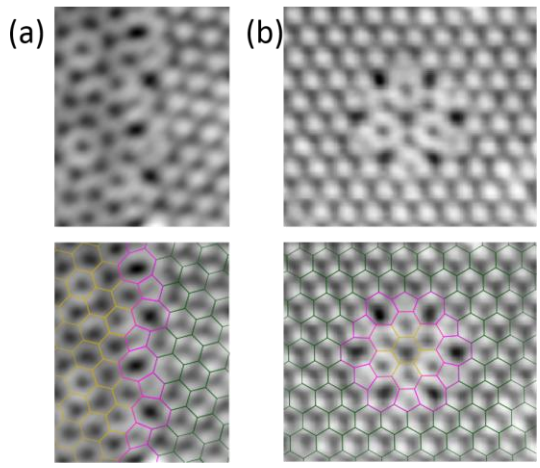

Figure 1: a) STM image of a zoomed area of a graphene nanoislands grown on Ni(111) by CVD. Different type of topological defect boundaries consisting on pentagon/heptagon units separate stripes (a) and quantum dots (b) of domains with 30° of relative rotation.