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Ar implantation beneath graphene on Ru(0001): nanotents and "can-opener" effect

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Abstract

Exposing a monolayer of graphene on ruthenium (g/Ru(0001)) to low energy Ar^+ ions leads to nanotent formation and "can-opener" effect, similar phenomena as observed for h-BN/Rh(111) targets [1]. Nanotents are extra protrusions in the sp^2 monolayers beneath which atoms are immobilized at room temperature. Annealing the Ar^+ implanted structures results in the "can-opener" effect, *i.e.*, the formation of the voids with a diameter about 2 nm within the graphene layer. The voids preferentially settle in the "hill" regions of the g/Ru(0001) superstructure and thus display spacial selectivity. This provides a convenient method to control defect positions within graphene membranes with nanometer precision. The results are obtained by scanning tunneling microscopy, low energy electron diffraction and photoemission, and are backed with density functional theory calculations.

Keywords: graphene, implantation, defect, "can-opener" effect, scanning tunneling microscopy

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