Hydration layers on $CaF_2(111)$ trapped by mechanically exfoliated graphene

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Although the confinement of thin water films resulting from exfoliation in ambient have been recognized in literature as such [1-4], the details of formation and many other properties are not yet known. In this talk we describe in detail the role of this confined hydration layer resulting from mechanical exfoliation in ambient and its persistence to heating, by studying the confined water layers for mechanically exfoliated graphene on $CaF_2(111)$ [5].

By the use of nc-AFM and KPFM we identify and characterize the properties of the intercalated water film, initially containing several water layers. By heating the system, we demonstrate the decay of hydration layers and the persistent ripening process of graphene patches in direct contact with the substrate. Upon further heating in an attempt to remove the persistent first hydration layer, we discover that it is virtually impossible to completely release the heavily trapped water. Instead, we create nanoblisters filled with water for thinner graphene sheet thicknesses, while thicker graphene sheets are ruptured to release the pressure of the heated water trapped underneath.

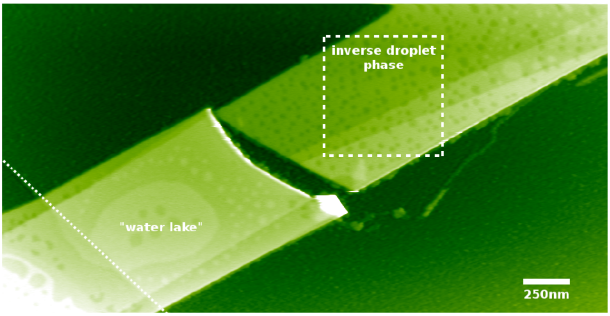

Figure 7: NC-AFM image of a FLG flake heated to 400 K. The annealing results in the decay of the hydration layers, containing domains of graphene in contact with the substrate in the inverse droplet phase (dashed square) surrounded by a thin hydration layer.

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