Graphene on metal surfaces

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The new material graphene (Noble Prize in Physics 2010) currently receives an enormous attention for its exciting properties [1], caused by its monoatomic thickness and the unique band structure arising from its lattice symmetry.

We study the epitaxial growth of graphene on a metal surface (here: Ir(111)), which leads to graphene of high structural quality which is only weakly bonded to the substrate [1, 2]. Complementing scanning tunneling microscopy (STM), we determined key structural parameters using an x-ray standing wave (XSW) analysis. The results are corroborated by extensive density functional theory (DFT) calculations incorporating non-local interactions [3]. The key finding is that graphene is weakly bound to Ir(111) by global van der Waals forces with an added local covalent-like contribution.

The electronic and geometric properties of graphene can be modified by intercalating alkali metals, rare earths, or oxygen. Important for the subsequent use of epitaxially grown graphene, the intercalation also makes exfoliation of the carbon sheet possible.

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