"Chemical" and "Mechanical" Engineering of Epitaxial Graphene

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Attractive properties of graphene can be exploited in various applications where the zero density of states at the Fermi energy and linear bands around it are easily subjected to tailor-made solutions. Besides electric field, a chemical adsorption either "on top" or "underneath" graphene, where typically charge transfer processes take place, is a suitable tool for graphene modifications. In epitaxial graphene systems deposition of atoms and molecules often leads to intercalation where species are pushed between graphene and its support. Besides the common effect of the charge donation, the intercalation can affect the binding interaction and more subtle properties of graphene, e.g. magnetism. In fact, properties of many layered materials, including copper- and iron-based superconductors, dichalcogenides, topological insulators, graphite and epitaxial graphene, can be manipulated by intercalation. However, the microscopic mechanism and dynamics of intercalation process is not well understood. To resolve this issue, we study the intercalation and entrapment of alkali atoms under epitaxial graphene on Ir(111) in real and reciprocal space by means of LEEM, STM, ARPES, LEED and vdW-DFT, and find that the intercalation is adjusted by the van der Waals interaction, with the dynamics governed by defects anchored to graphene wrinkles [1]. Another direction of graphene electronic structure tailoring is related to a more precise stress control which can be realized by graphene growth on stepped surfaces and we focus to such system [2] in order to exploit uniaxial strain engineering.

[1] M. Petrović, et al., Nature Communications 4 (2013) 2772.
[2] I. Šrut Rakić, et al., Carbon 56 (2013) 193.