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Stacking Relations and Graphene-Substrate Interactions Probed by Low-Energy Electron Microscopy

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Graphene and other 2D materials are considered as building blocks for future electronic devices. In order to reach that goal, interfacial interactions and structural relations between the individual building blocks and/or between a 2D material and the substrate used for growth or as support in a device must be considered. Several excellent experimental tools exist which can be employed to answer these questions. In particular surface spectroscopies like ,e.g., photoelectron spectroscopy (PES, ARPES) and microscopies such as scanning probe techniques (STM, STS) or low-energy electron microscopy (LEEM) are excellently suited for 2D materials.
In this contribution I will survey recent results from low-energy electron microscopy (LEEM) and its related techniques. The first part will concentrate on the growth of graphene by chemical vapor deposition on Cu substrates [1]. It is shown that the Cu substrate undergoes a faceting with (111) oriented terraces separated through (112) facets. Bilayer graphene domains on such facetted substrates show domains with different Bernal stacking (AB vs. AC) with domain boundaries coinciding with the (112) facets, which signals uniaxial strain in these areas. The observed structural imperfections are still present after transfer of the graphene to another substrate. The second part of my presentation will concentrate on graphene grown on SiC(0001) substrates by the so-called polymer-assisted sublimation growth (PASG) [2]. The stacking order of SiC below graphene as well as different stacking domains in bilayer graphene are discussed [3].

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[2] M. Kruskopf, D.M. Pakdehi, K. Pierz, S. Wundrack, R. Stosch, T. Dziomba, M. Götz, J. Baringhaus, J. Aprojanz, C. Tegenkamp, J. Lidzba, T. Seyller, F. Hohls, F.J. Ahlers, H.W. Schumacher, 2D Materials 3 (2016) 41002.

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