IBS Center for Multidimensional Carbon Materials

Special Guest Speaker

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The stacking sequence of graphene revealed by in-situ SEM Observation of CVD growth and hydrogen etching

Oct 10 MON 3P.M. | Bldg. 101 Seminar room on the 1st floor

The recognition that the addition of each new layer of graphene modifies the electronic structure and produces a different material with unique properties has generated great interest in the preparation of few layer graphene. However, controlled growth of large-area FLG is a difficult challenge because of incomplete understanding of adlayer graphene growth and the mechanisms of layer stacking. Here we demonstrate that real-time imaging by in-situ scanning electron microscopy (SEM) enables the investigation of the growth behavior of adlayer graphene on platinum under controlled atmosphere. Imaging during growth and etching allows to unravel the link between mechanistic details and growth kinetics[1] and to distinguish between graphene layers that are inserted underneath or forming on top of the initial layer. The observation of layer dependent etching rates facilitates the determination of the relative strength of the graphene-graphene and graphene-substrate interaction. Anisotropic etching rates extracted from evolution of the shape of islands and vacancy islands (holes) indicate a strong interaction of graphene edges with the Pt step edges. Using STM imaging and DFT calculations we confirm a strong coupling between the edge atoms of graphene sheets with the Pt substrate.

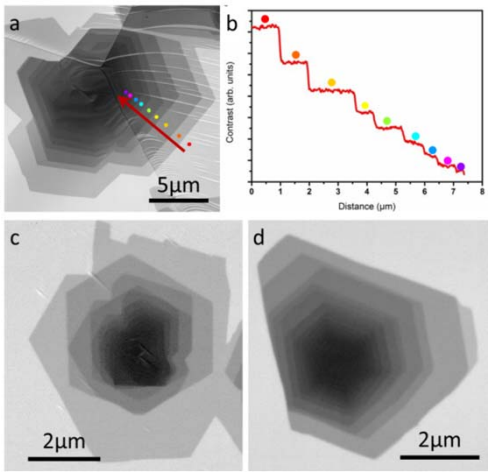

Fig. 1. Real-time images recorded during in-situ growth in the SEM. a, b, The SEM image (a) and the corresponding plot (b) show that up to 9 layers can be distinguished within the contrast range. The different colored dots along the arrow designate the location and corresponding layer number. Note that the lightest shade marked by a red dot corresponds to Pt covered by SLG. c, Vertical layer stacking showing a 30° rotation between successive layers. d, Hexagonal shape distorted by interaction with the Pt surface in ABA stacked FLG.

References
[1] Zhu-Jun Wang, Gisela Weinberg, Qiang Zhang, Thomas Lunkenbein, Achim Klein-Hoffmann, Michalina Kurnatowska, Milivoj Plodinec, Qing Li, Lifeng Chi, R. Schloegl, and Marc-Georg Willinger, *ACS* Nano, 9 (2), 1506–1519, (2015)

You are cordially invited to attend!