Epitaxial Graphene Layer on Silicon-Carbide

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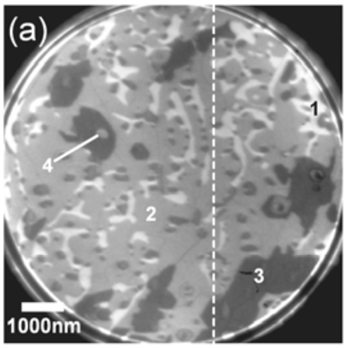
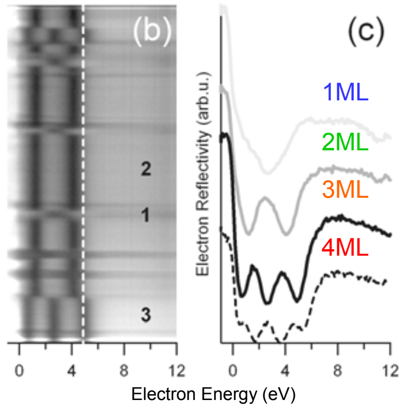
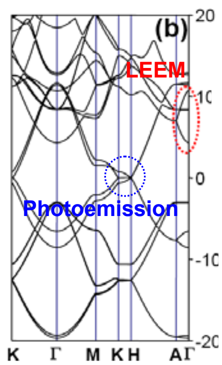
Film Characterization



T. Ohta *et al.*, New J. Phys., 10, 023034 (2008).

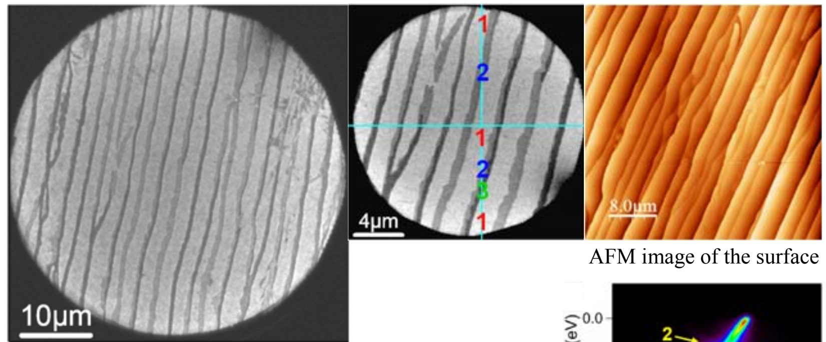




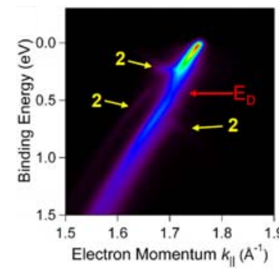
Growth morphology, domain size and local thickness of graphene films prepared in ultrahigh vacuum (UHV) are studied using low energy electron microscopy (LEEM). Graphene layers of different thickness can be identified by electron reflectivity spectra. Our study demonstrates the importance of the interface carbon layer for the morphology of subsequent graphitization process.

Band structure from H. Hibino *et al.*, Phys. Rev. B 77, 075413 (2008)

Large-Area Graphene Film



AFM image of the surface



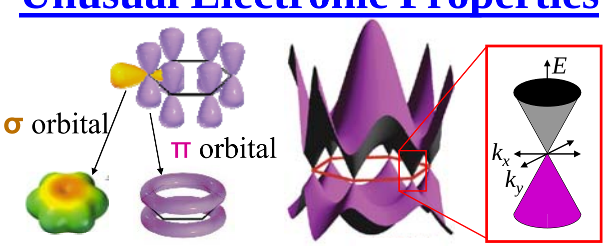
Photoemission spectra of the π-band near Fermi-level

Large-area graphene films are produced by high temperature annealing in a background of Ar. While the valence band and the interface structures are the same as UHV-prepared films, the domain size and the uniformity of the film are drastically improved (see figures above and left). The kinetics of graphene formation is expected to be different in the presence of Ar, and is subject of future studies. This newly developed synthesis opens the possibility of practical applications of epitaxial graphene to electronic and optical devices.

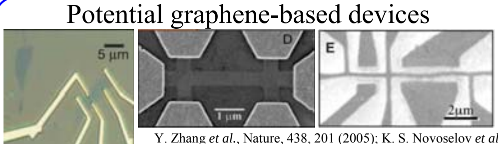
K. V. Emtsev, T. Ohta *et al.*, in preparation.

Why Graphene?

Unusual Electronic Properties



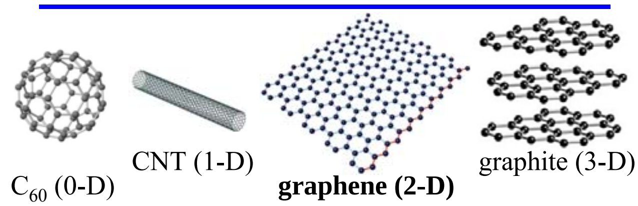
Potential graphene-based devices



Y. Zhang *et al.*, Nature, 438, 201 (2005); K. S. Novoselov *et al.*, Science, 306, 666 (2004); C. Berger *et al.*, Science, 312, 1191 (2006)

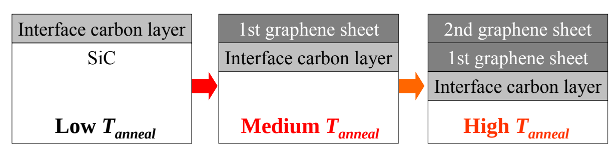
Technological advantages: high carrier mobility (25,000 $cm^2/V \cdot sec$) and long coherent length (> 1μm)
Potential applications: high-speed electronics, THz emitter, sensitive gas sensors etc.

Carbon-Based Nanomaterials



Graphene Formation on SiC

Graphene films are formed by thermal decomposition of SiC substrates; Si evaporates, and the surface become rich in carbon atoms. By low temperature annealing (>1100 C), a SiC surface is initially covered with an interface carbon layer. Higher temperature annealing converts this interface carbon layer to a graphene layer by forming a new interface carbon layer underneath.



Interface layer formation
1st graphene sheet formation
2nd graphene sheet formation

Acknowledgments

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