⑥ Number-of-layer dependence of structure and electronic properties of epitaxial few-layer graphene

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Motivation

We are aiming at creating single-crystal substrates of few-layer graphene (FLG). FLG is attracting intense attention as a future electronics material due to its superior electronic transport properties and compatibility with planar lithographic techniques. However, there are no industrially applicable methods for fabricating FLG substrates. We are investigating the structure and electronic properties of FLG epitaxially grown on SiC substrates, with the aim of optimizing the growth condition and clarifying the interaction between SiC and FLG.

Originality

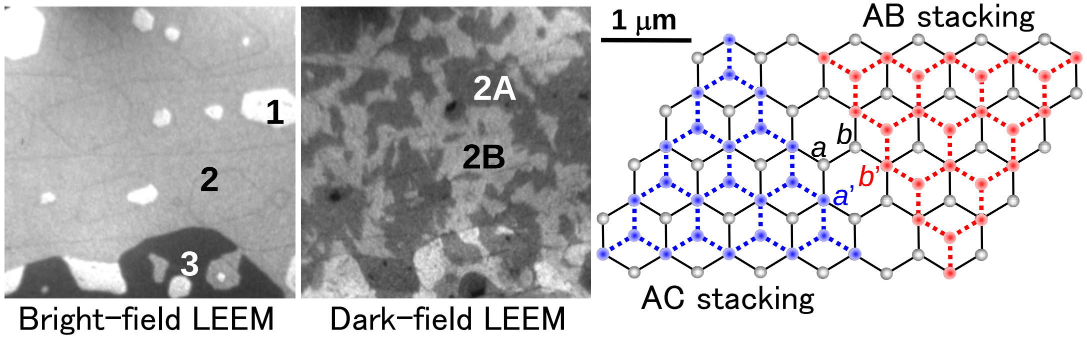
Low-energy electron microscopy (LEEM) can be used to digitally count the number of graphene layers on SiC microscopically. The combination of LEEM and other surface electron microscopic techniques makes it possible to investigate the structure and electronic properties of FLG in each thickness. We have found stacking domains in bilayer graphene, have clarified the number-of-layer dependence of the C1s binding energy and work function, and have established a method suitable for *in situ* observations of graphene growth.

Impact

Silicon MOSFETs are approaching the limit of miniaturization. Therefore, there is an intense search for logic devices and electronics materials that can replace them. Graphene has a wide potential in electronics applications, ranging from channel materials for MOSFETs to quantum effect devices, and is one of the most promising post-silicon electronics materials. Single-crystal FLG substrates are essential for graphene electronics and could contribute to its industrialization.

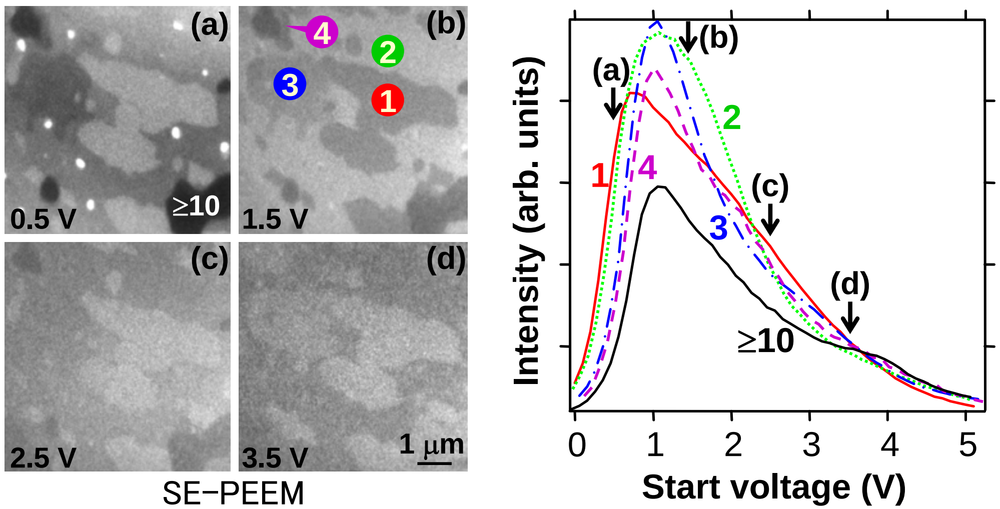
Stacking domains in bilayer graphene

Although bilayer graphene looks homogeneous in the bright-field LEEM images, stacking domains are clearly seen in the dark-field LEEM images.



Thickness dependence of work function

Photoelectron emission microscopy (PEEM) images formed from secondary electrons (SEs) are used to obtain SE emission spectra for each thickness. The threshold energies provide the number-of-layer dependence of the work function.



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