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Epitaxial graphene: Structure, growth and molecular interactions
ANDREW WEE, WEI CHEN, SIEW WAI POON, HAN HUANG, SHI CHEN, DONGCHEN QI, ENG SOON TOK, KIAN PING LOH, National University of Singapore — The discovery of graphene has opened up a new paradigm in nanoelectronics that could offer better performance than conventional semiconductor devices. We used *in situ* scanning tunnelling microscopy (STM), synchrotron synchrotron radiation techniques and density functional theory (DFT) calculations to investigate the structure of the various reconstructions of 6H-SiC(0001) prior to its thermal decomposition to form epitaxial graphene (EG). Using Co-decoration technique coupled with STM, the evolution of EG was found to preferentially begin at SiC step edges and occurs with the loss of Si and breakdown of the C-rich $(\sqrt{6}\times\sqrt{6})R30^\circ$ template, which provides the C source for graphene growth. The C-rich phase that forms at the interface acts as a buffer layer for graphene from the underlying bulk SiC. We show that the transition from monolayer to trilayer EG adopts a bottom-up growth mechanism. With increasing annealing temperature, the fluorescence yield of Si K-edge NEXAFS indicates an increase in disorder of Si atoms in the SiC substrate beneath the surface due to out-diffusion of Si atoms to the surface forming increased Si vacancies. We also show that EG thermally grown on 6H-SiC(0001) can be p-type doped via a novel surface transfer doping scheme by modifying the surface with the electron acceptor, F4-TCNQ.

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