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# Charge Neutral Quasi-Free-Standing Graphene on 6H-SiC(0001) Surface by Pd Silicidation and Intercalation

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We investigated the atomic and electronic properties of graphene grown by Pd silicidation and intercalation using LEED, STM, and ARPES. Pd was deposited on the 6H-SiC(0001) surface at RT. The formation of Pd silicide gives rise to breaking of Si-C bonds of the SiC crystal, which enables to release C atoms at low temperature. The C atoms are transformed into graphene from 860°C according to the LEED patterns as a function of annealing temperature. Even though the graphene spots were observed in the LEED pattern and the Fourier transformed STM images after annealing at 870°C, the topography images showed various superstructures so that graphene is covered with Pd silicide residue. After annealing at 950°C, monolayer graphene was revealed at the surface. The growth of graphene is not limited by surface obstacles such as steps and defects. In addition, we observed that six protrusions consisting of the honeycomb network of graphene has same intensity meaning non-broken AB-symmetry of graphene. The ARPES results in the vicinity of K point showed the non-doped linear $\pi$ band structure indicating monolayer graphene decoupled from the SiC substrate electronically. Note that the charge neutrality of graphene grown by Pd silicidation and intercalation was sustained regardless of annealing temperature in contrast with quasi-free- standing graphene induced by H and Au intercalation. Further annealing above 1,000°C accelerates sublimation of the Pd silicide layer underneath graphene. This results in appearance of the (6r3x6r3)R30° structure and dissolution of the $\pi$ bands for quasi-free-standing graphene.

**Keywords:** graphene, Pd, silicide, STM, ARPES