EPITAXIAL SILICENE

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Silicene [1], the all silicon analogue of graphene and its potential challenger, has been theoretically conjectured recently [2]. Its synthesis has just been reported [3]: silicon deposition onto Ag(110) surfaces reveals the formation of silicon nano-ribbons (NRs) [4], in a massively parallel arrangement along the [-110] direction. Their atomic geometry was derived by high-resolution STM images showing a honeycomb arrangement, i.e., a silicene-like structure, further supported by theoretical calculations [5,6]. These one-dimensional (1D) silicene NR's, showing quantized/edge states in STS imaging [7], self-assemble by lateral compaction to form a grating with a pitch of $\sim$2 nm covering the entire substrate surface [8]. The band dispersion along the NRs direction reveals, as for graphene, massless Dirac fermions resulting from the 1D projection of π and π^* Dirac cones [9]. This points to sp^2 hybridization, which is further confirmed on the one hand by the incidence angle dependence of Electron Energy Loss Spectra near the silicon K absorption edge [10]: the measured anisotropy is very similar to that found for the carbon K edge of HOPG graphite [11], and, on the other hand, by the strong resistance toward oxidation [12]. Recently, two-dimensional silicene-like sheets have been also obtained in Marseille upon Si deposition onto Ag(111) [13]. Such sheets might be also stable on insulating substrates [14]. Finally, the implications of these novel results for new physics and applications will be discussed.

References

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