Supplementary Information

Synthesis of Nonepitaxial Multilayer Silicene Assisted by Ion Implantation

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Calculations: The diffraction patterns in Fig. 3b could be used to derive the interplanar distances. In Fig. S2a, the length of the dashed line, which contains a double reciprocal vector, is equal to 9.86 nm^{-1}, so that the length of the reciprocal vector is 4.93 nm^{-1}. The inverse of 4.93 nm^{-1} is equal to 0.2028 nm that corresponds to the (222) interplanar distance (0.2027 nm) of B_4C. The length (17.48 nm^{-1}) of the dashed line as shown in Fig. S2b contains a quadruple reciprocal vector. Hence, the length of the reciprocal vector is 4.37 nm^{-1}. The inverse of 4.37 nm^{-1} is equal to 0.2288 nm that corresponds to the (002) interplanar distance (0.2264 nm) of B_4C.

Similarly, the length of the dashed line in Fig. S3a, which is equal to 10.5 nm^{-1}, contains a quadruple reciprocal vector, so that the length of the reciprocal vector is 2.625 nm^{-1}. The inverse of 2.625 nm^{-1} is equal to 0.3809 nm that corresponds to the (½½-10) interplanar distance (0.381 nm) of multilayer silicene. The length (11.13 nm^{-1}) of the dashed line as shown in Fig. S3b contains a double reciprocal vector. Hence, the length of the reciprocal vector is 5.565 nm^{-1}. The inverse of 5.565 nm^{-1} is equal to 0.1796 nm that corresponds to the (11-21) interplanar distance (0.182 nm) of multilayer silicene. These calculations, which derived from the experimental results, are in agreement with the theory and the error rate is less than 5%, indicating that the results are believable.
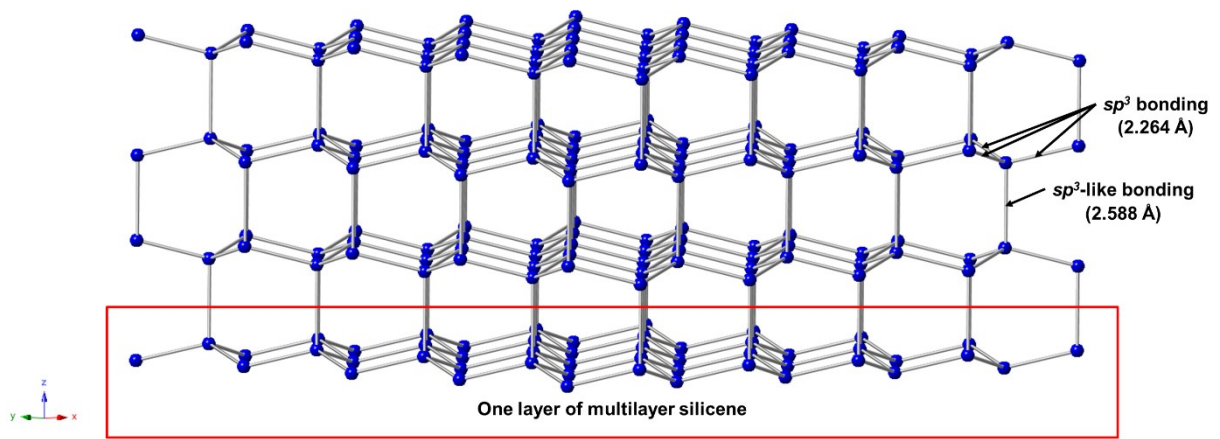
Fig. S1 The lonsdaleite Si crystal structure with *sp³–sp³*-like mixed orbital hybridization.
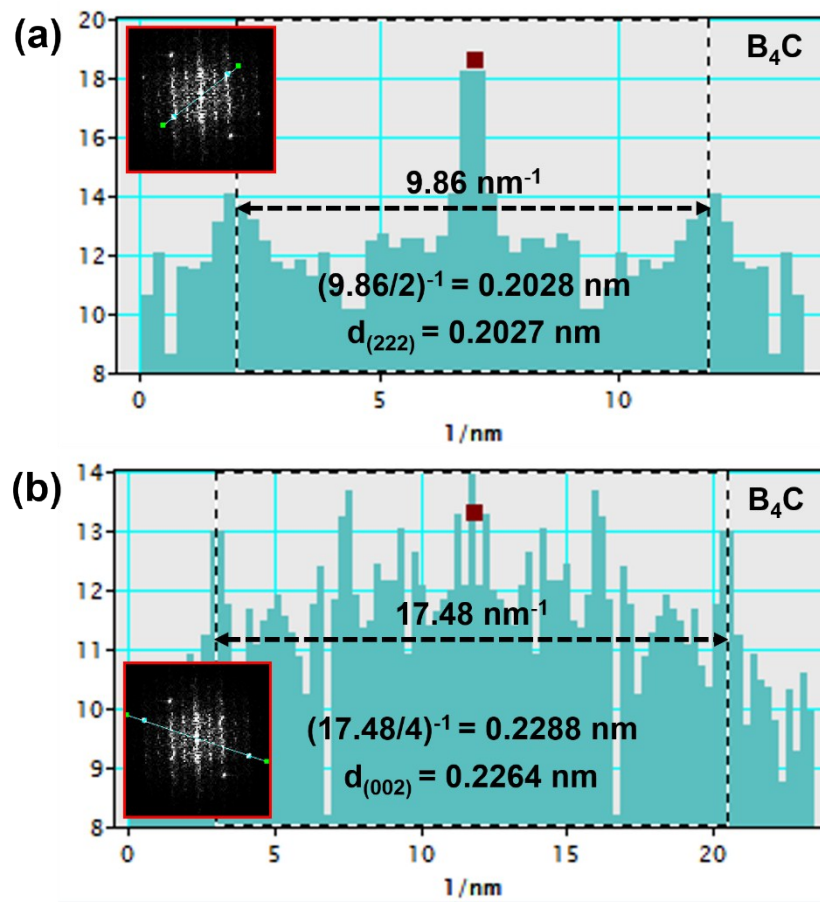
Fig. S2 (a) The distance between (222) reciprocal points of B_4C. (b) The distance between (002) reciprocal points of B_4C.
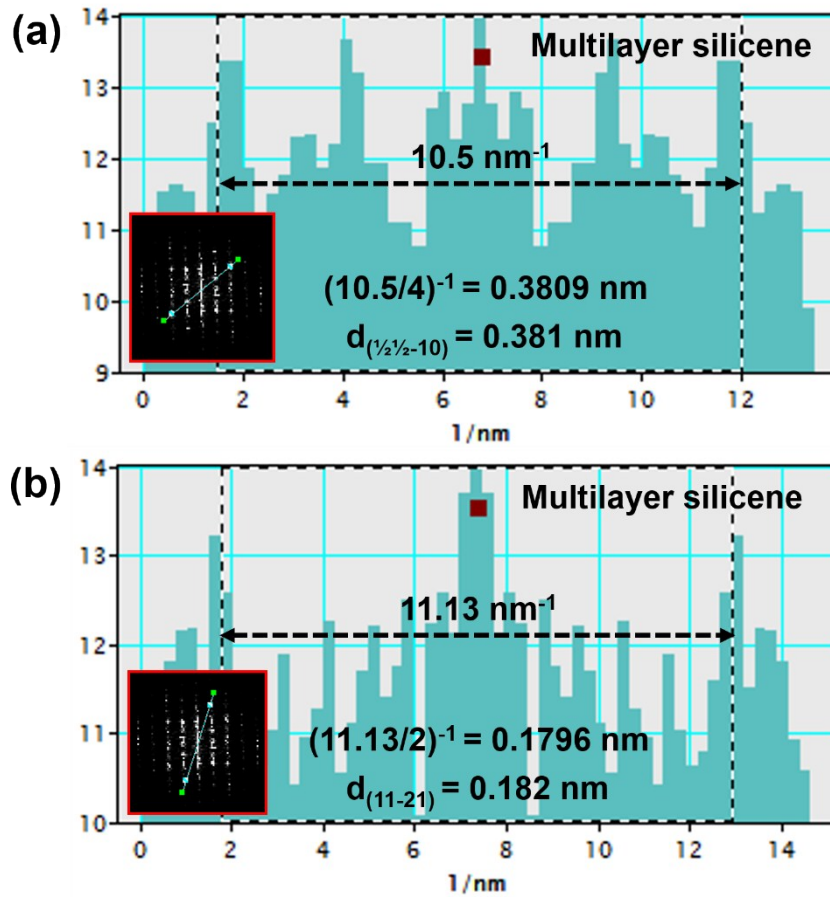
Fig. S3 (a) The distance between (½½-10) reciprocal points of multilayer silicene. (b) The distance between (11-21) reciprocal points of multilayer silicene.