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Epitaxial silicene formed on single-crystalline ZrB_2 thin films: structure and electronic properties[1] ANTOINE FLEURENCE, RAINER FRIEDLEIN, YING WANG, YUKIKO YAMADA-TAKAMURA, School of Materials Science and Research Center for Integrated Science, Japan Advanced Institute of Science and Technology (JAIST) — The experimental realization of extended, two-dimensional sheets of silicene, the silicon counterpart of graphene, has been elusive so far. Here, we demonstrate that such a two-dimensional, epitaxial honeycomb Si layer forms through surface segregation on a metallic zirconium diboride (ZrB_2) film grown itself epitaxially on Si(111). The honeycomb Si layer uniformly covers the ZrB_2(0001) surface forming a (2×2) reconstruction. Surface-sensitive core-level photoelectron spectroscopy performed using a photon energy of 130 eV identifies Si atoms in different chemical states that are either in contact with Zr atoms or not, confirming details of the slightly-buckled honeycomb structure obtained through scanning tunneling microscopy. Angle-resolved ultraviolet photoelectron spectra reflect surface electronic states related to the predicted band structure of slightly-buckled, free standing silicene together with those of the uppermost Zr layer.

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