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Formation of silicene-germanene heterostructures by Ge deposition on epitaxial silicene YUTO AWATANI, ANTOINE FLEURENCE, YUKIKO YAMADA-TAKAMURA, Japan Advanced Institute of Science and Technology — Silicene and germanene are two dimensional honeycomb sheets composed of Si and Ge atoms. Epitaxial silicene and germanene form spontaneously on ZrB2(0001) thin films grown on Si(111) [1] and Ge(111) [2] substrates and can be identified by (2X2)- and ($\sqrt{3}$X$\sqrt{3}$)-reconstruction of ZrB2(0001) respectively. In the present work, we demonstrate that silicene-germanene heterostructures can be formed by deposition of Ge on epitaxial silicene and by subsequent annealing. LEED and STM analysis revealed the growth of the following Si-Ge structures depending on preparation conditions. (1): After annealing at 830 K, (2X2)- and ($\sqrt{3}$X$\sqrt{3}$)-reconstructed areas existed side by side, which suggests that a two-dimensional silicene-germanene heterostructures is formed. (2): After annealing at 1070 K, the surface is (2X2)-reconstructed, with a heterogenous atomic contrast different from silicene which suggests the incorporation of Ge atoms in the silicene lattice. (3): After annealing this mixed Si-Ge layer at 830 K, a (2$\sqrt{3}$X2$\sqrt{3}$)-reconstruction is observed, in agreement with the overlapping of ($\sqrt{3}$X$\sqrt{3}$)- and (2X2)-reconstructed layers. The structure is presumably a silicene-germanene heterostack structure. [1] A.Fleurence, et al., Phys. Rev. Lett. 108 245501(2012). [2] A.Fleurence, et al., APS March Meeting 2016.

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