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Temperature-dependent phase transitions in epitaxial silicene on ZrB_2(0001) ANTOINE FLEURENCE, YUKIKO YAMADA-TAKAMURA, Japan Advanced Institute of Science and Technology — Silicene differs from graphene, its carbon counterpart, by a mixed sp^2/sp^3 hybridization of the Si atoms that gives it particularly interesting mechanical and electronic properties. Silicene can form by the spontaneous and self-terminating segregation of Si atoms on the (0001) surface of zirconium diboride (ZrB_2) thin films grown on Si(111) [1]. This stable form of silicene is particularly suitable for the investigation of the temperature dependence of its mechanical properties. Whereas, the amount of Si atoms does not vary, scanning tunneling microscopy and low-energy electron diffraction clearly indicate that two reversible phase transitions occur when the temperature is raised. At room-temperature, the silicene sheet is textured into one-dimensional arrays of interconnected 2.7 nm-wide ribbon-shaped stress domains [1]. Around 870 K, this ordered surface evolves into a surface made of wider domains with no ordering of the domain boundaries. At 930 K, the silicene sheet loses its structure and turns into a two-dimensional gas of Si atoms. While cooling down, silicene crystallizes reversibly. The origin of the phase transitions of epitaxial silicene will be discussed.
[1] A. Fleurence et al. Phys. Rev. Lett. 108 245501 (2012).

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