

Coexistence of quasi-1D (7×7) and (5×5) phases on vicinal Si(557) surfaces

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The separated quasi-one-dimensional (7×7) and (5×5) phases on vicinal Si(557) surfaces were successfully realized by changing the crystallographic orientation and thermal treatment conditions. A small change in the crystallographic orientation of the Si(557) surface stabilized the quasi-one-dimensional (5×5) phase of a (111) facet on vicinal Si(557) surfaces and made it coexist with a quasi-one-dimensional (7×7) phase after an optimal thermal treatment, whereas only the quasi-one-dimensional (7×7) phase was stable on the Si(557) surface. Interestingly, this causes the (111) terraces with different widths (L) to prefer only one of the 5×5 ($L=12$) and 7×7 ($L=9$) phases resulting in long-range order of both phases along the step edge direction, which was observed by scanning tunneling microscopy (STM) and was supported by first principle calculations. In contrast, the quasi-one-dimensional (5×5) and (7×7) phases were arranged randomly across the step edge direction. The change of surface morphology of vicinal Si(557) surfaces will be discussed with STM images and theoretical calculations by changing crystallographic cutting angles and thermal treatment conditions.