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Origin of the wide Si(7 7 17) domain parasitic on Si(5 5 12) surface

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Recently the high-index and single-domain Si(5 5 12) has attracted much attention due to its potential application as a template for one dimensional nanowire fabrication. However, another high-index and single-domain (7 7 17) plane has not been reported, although they have similar plane directions of only 0.3 degree off and commonly consist of (2 2 5) and (3 3 7) sections [i.e., $(5\ 5\ 12) = 2 \times (3\ 3\ 7) + (2\ 2\ 5)$ and $(7\ 7\ 17) = (3\ 3\ 7) + (2\ 2\ 5)$]. From the recent STM investigation on Si(5 5 12), we have detected the wide Si(7 7 17) domains parasitic on Si(5 5 12). Most of wide (7 7 17) domains appear in the terrace adjacent to the step parallel to (-1 1 0) row direction. In a single terrace, the (7 7 17) domain extends to a few hundreds Angstrom from the step, then transforms to (5 5 12). Some (7 7 17) domains are also detected from the bent surface without steps. These wide and pure (7 7 17) domains, appearing near the step or on the bent surfaces, are experiencing the compressed stresses, and these excessive stresses replace the compressed stress originating from a (3 3 7) section in (5 5 12). Therefore, the extra (3 3 7) section is not required in a (5 5 12) plane under such stresses, which results in (7 7 17) domain until such local compressed stresses are released.

