[S-12]

Stress-induced Orientation Transformation of high-index Si Surfaces: From (5 5 12) to (7 7 17)

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The Si(5 5 12), one of high-index Si surfaces existing between (001) and (111), is reconstructed to a relatively planar surface owing to compensation of opposite stresses generated by composing 1-D features such as dimer facing adatom(D/A) row and tetramer(T) row. However, like defects, some distinct areas, such as regions attached to the (113) facet, have a periodicity, 3.78 nm, which is shorter than that of (5 5 12), 5.35 nm, and is same as that of (7 7 17). In the present study, firstly, the atomic structure of this (7 7 17) area has been identified by scanning tunneling microscopy (STM). When the reconstruction of such a (7 7 17) unit is compared with that of a (5 5 12) unit, one of subunits composing (5 5 12) unit (that is, D(337) which is a (337) unit with D/A row) is missing. As D/A row tends to be formed under the tensile stress and T row under compressive stress, it has been deduced that those (7 7 17) areas are under the compressive stress originating from the (113) facet. Besides the area attached to the facet, from the upper terrace area where two facets are crossing, the smooth transformation from (5 5 12) to (7 7 17) has been detected. Detailed analysis of this specific area revealed the fact that such an area with inhomogeneous stress (that is, the area attached to the parallel (113) facet is under compressive stress while the rest area is not) should accompany the transformation from D/A row to T row even within the same (337) unit. It has been concluded that, as the specific area with (7 7 17) are under compressive stress, (7 7 17) appearing on the (5 5 12) surface can be utilized as a stress sensor in such a local area of nanometer scale.