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What makes Si-homoepitaxy on Si(5 5 12) possible? : Mutual transformation between chain-wall and Si-dimer adsorption site

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The fine steps of Si-homoepitaxy has been studied by scanning tunneling microscopy using the reconstructed Si(5 5 12) with 1-D symmetry through depositing Si atoms under UHV. Although various 1-D features have been evolved until recovering the identical Si(5 5 12), the basic building-block is turned out to be a Si-dimer, adsorbing at the (3 3 7) sub-unit containing dimer/rest-atom features. In case of adsorption on the (3 3 7) sub-unit containing tetramer features, 1-D structural transformation of the tetramer to dimer/rest-atom has been found to be a pre-requisite condition. Such preferential adsorption facilitates Si-dimers form 1-D dimer row with 2x periodicity in the confined area between honeycomb chain-walls. As soon as Si-dimers fill the possible adsorption sites, the excessive Si atoms arriving at such confined area drive the Si-dimer row to form Si-chain with 1x periodicity. If once the chain-wall is surrounded by the newly-formed and neighboring chain-walls, the inverse-transformation occurs, that is, the old chain-wall transforms to dimer/rest-atom features which can accept the additional Si-dimers. Besides such mutual transformation between the Si-dimer adsorption site and the honeycomb chain-wall, the facetting originating from the in-commensurating mismatching between (5 5 12) and (3 3 7) periodicities and the existence of critical thickness are typically observed in the Si-homoepitaxy on Si(5 5 12).