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Morphology of <111>-oriented Si nanowire and its physical origin TAO XU, JEAN PHILIPPE NYS, MAXIME BERTHE, BRUNO GRANDIDIER, DIDIER STIEVENARD, INSTITUT D'ELECTRONIQUE, DE MICROELECTRONIQUE ET DE NANOTECHNOLOGIE TEAM — Si nanowires with a <111> orientation, synthesized by vapor-liquid-solid process with low silane partial pressure reactant and gold as the catalyst, are known to exhibit sawtooth facets containing gold adsorbates. We report herein the study of the nanowire morphology by means of transmission electron microscopy and scanning tunneling microscopy. The nanowire sidewalls are found to have two different widths depending on the three equivalent <-1-12> or <11-2> orientations. In addition the direct incorporation of Si atoms onto the sidewalls occurs at the growth temperature of 550 degrees and shows two different growth rates for the two types of sidewalls. By investigating the atomic structures of the sidewalls, the STM topographic images reveal that the <111> facets of the sidewalls have a 6 x 6 phase at room temperature. Because this phase and its counterpart, the $\beta-\sqrt{3}$ x $\sqrt{3}$ phase that occurs at the nanowire growth temperature, consists of two unit cell with two inequivalent parts, we explain the trigonal symmetry as well as the higher lateral growth rate on the widest sidewalls by the barrier energy that exists between both unit cells.

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