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Atomic scale structure of Si nanowire TAO XU, JEAN PHILIPPE NYS, MAXIME BERTHE, BRUNO GRANDIDIER, DIDIER STIEVENARD, Institut d'Electronique, de Microelectronique et de Nanotechnologie, WANGHUA CHEN, RODRIGUE LARDE, EMMANUEL CADEL, PHILIPPE PAREIGE, University and INSA of Rouen — In this work, we have succeeded to observe the atomic structures of Au assisted Vapor-liquid-solid grown Si nanowire facetted sidewalls by scanning tunnelling microscopy (STM) at low temperature. By combining transmision microscopy observations with STM measurements, we were able to identify the differents facets along the growth direction of the nanowires. For nanowires with diameters larger than 150 nm, the facets orientation alternates between the [111] and [113] directions, whereas for smaller diameters, the {113} facets are replaced by facets with an orientations making a larger angle with the [111] direction. Imaging the facets at the atomic resolution clearly revealed that the facet reconstructions are induced by Au atoms. From the spectroscopic measurements, the facets are found to be metallic. In order to obtain the impurity distribution below the surface, 3D atom probe tomography analyses were performed. A uniform distribution of Boron impurities is observed in the core of the nanowire and the impurity concentration agrees well with the ratio of the flow rates between silane and diborane. Finally, such results are compared to the conductivities of single nanowires measured in field effect transistor devices.

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