

NW-001

Interplay between Defect Propagation and Surface Hydrogen in Silicon Nanowire Kinking Superstructures

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The vapor-liquid-solid (VLS) method, where the "liquid" catalytic droplets collecting atoms from vapor precursors build the solid crystal layers via supersaturation, is a ubiquitous technique to synthesize 1-dimensional nanoscale materials. However, the lack of fundamental understanding of chemical information governing the process inhibits the rational route to the structural programming. By combining the in situ or operando IR spectroscopy with post-growth high resolution electron microscopy, we show the strong correlation between the surface chemical species concentration and nanowire structures. More specifically, the critical role of surface adsorbed hydrogen, generated from the decomposition of Si_2H_6 precursor on the interplay between nanowire / kinking and the defect propagation is demonstrated. Our results show that adsorbed hydrogen atoms are responsible for selecting σ -oriented growth and indicate that a twin boundary imparts structural coherence. The twin boundary, only continuous at / kinks, reduces the symmetry of the trijunction and limits the number of degenerate directions available to the nanowire. These findings constitute a general approach for rationally engineering kinking superstructures and also provide important insight into the role of surface chemical bonding during VLS synthesis.

Keywords: silicon, nanowire, kinking, defect, surface, hydrogen

NW-002

Layer Controlled Synthesis of Graphene using Two-Step Growth Process

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Graphene is very interesting 2 dimensional material providing unique properties. Especially, graphene has been investigated as a stretchable and transparent conductor due to its high mobility, high optical transmittance, and outstanding mechanical properties. On the contrary, high sheet resistance of extremely thin monolayer graphene limits its application. Artificially stacked multilayer graphene is used to decrease its sheet resistance and has shown improved results. However, stacked multilayer graphene requires repetitive and unnecessary transfer processes. Recently, growth of multilayer graphene has been investigated using a chemical vapor deposition (CVD) method but the layer controlled synthesis of multilayer graphene has shown challenges. In this paper, we demonstrate controlled growth of multilayer graphene using a two-step process with multi heating zone low pressure CVD. The produced graphene samples are characterized by optical microscope (OM) and scanning electron microscopy (SEM). Raman spectroscopy is used to distinguish a number of layers in the multilayer graphene. Its optical and electrical properties are also analyzed by UV-Vis spectrophotometer and probe station, respectively. Atomic resolution images of graphene layers are observed by high resolution transmission electron microscopy (HRTEM). This research was supported by the MSIP (Ministry of Science, ICT and Future Planning), Korea, under the "IT Consilience Creative Program" (IITP-2015-R0346-15-1008) supervised by the IITP (Institute for Information & Communications Technology Promotion).

Keywords: graphene, chemical vapor deposition