Thermal behavior and decomposition mechanism of InAs nanowires: in-situ transmsision electron microscopy study

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The rapid advancement of *in-situ* electron microscopy techniques, e.g. heating, cooling, liquid cell, and mechanical/electrical measurements[1,2,3], makes electron microscopes become a test bed to explore physical and chemical properties of many individual nanomaterials. Specifically, because it is possible to observe the atomic behavior of nanomaterials due to the availability of state-of-the-art transmission electron microscopy (TEM) techniques, many scientists and researchers are trying for monitoring the reaction phenomena of nanomaterials at the atomic scale under varying environmental conditions in TEM. Furthermore a few researchers have been adopting the electron beam in TEM to manipulate nanomaterials[4,5,6,7,8,9].

In this study, the in-situ heating experiments of InAs nanowires were carried out to investigate the thermal behavior of nanowires and the same experiment was repeated at various current densities to understand the effect of electron beam during the in-situ heating. The vaporization-like decompostion behavior of the InAs nanowires was observed during the in-situ heating, free from the existence of any liquid phase. The decompostion temperature of the InAs NWs depended on the current density of the incident electrons; the decompostion temperature was reduced with increaseing the current density of the incident electron beam. At the low current, it was confirmed that thermodynamically stable surface facets were emerged during the heating. The enhanced vaporization of the InAs NWs was observed at the high current density of the incident electron beam. The thermal behavior and decomposition mechanism were demonstrated based on molecular dnamic simulation and finite element analysis.

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