Crystal structural analysis of $InAs_xP_{1-x}$ nanowire exploiting high resolution X-ray diffraction.

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Research on nanowire has attracted the attention of scientists and engineers due to both fundamental study relating its growth mechanism and the unique electrical properties for futuristic electronic device. Specially, the strain effect on nanowires significantly affect the charge transport properties since the strain can change their electronic structure. Recently, Kim et al[1] reported the electromechanical properties of individual InAsP nanowires under a uniaxial tensile strain by transmission electron microscopy (TEM). They observed a linear increase of the relative current, ΔI/I0, with increased tensile strain in the InAsP nanowire. They also revealed the origin of the specific electromechanical properties stemmed from piezoresistive effect by considering the microstructural and transport properties of nanowire. Though they chose the specific composition of nanowire with As : P =0.81 :0.19, more compositional modification is needed for choosing the best composition to represent the best electromechanical properties.

Here, we synthesized diverse composition of $InAs_xP_{1-x}$ nanowires varying phosphorus doping time. We first revealed phase of InAsP nanowire whether it is Zinc-blende (ZB) or Wurtzite (WZ) using phi (φ) scan methods. Based on result of phase analysis, we carefully determined the lattice parameter and the chemical composition of nanowires depending on phosphorus doping time. To analyze electromechanical properties in the InAsP nanowire, it is very important to prove whether intrinsic strain on nanowire exist or not. We observed that strain on InAsP nanowire from Si substrate is totally relaxed by measuring reciprocal space mapping (RSM). We finally suggest the best condition to grow InAsP nanowire comparing the lattice constant of $InAs_xP_{1-x}$ nanowire and Si substrate.

Reference

1. J.H. Lee, M. W. Pin, S. J. Choi, M. H. Jo, J. C. Shin, S. Hong, S. M. Lee, B. Cho, S. J. Ahn, N. W. Song, S. Yi, and Y. H. Kim, *Nano Lett*. **2016**, 16, 6738