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Characterization of SiC nanowire synthesize by Thermal CVD

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One-dimensional nanosturctures such as nanowires and nanotube have been mainly proposed as important components of nano-electronic devices and are expected to play an integral part in design and construction of these devices. Silicon carbide(SiC) is one of a promising wide bandgap semiconductor that exhibits extraordinary properties, such as higher thermal conductivity, mechanical and chemical stability than silicon. Therefore, the synthesis of SiC-based nanowires(NWs) open a possibility for developing a potential application in nano-electronic devices which have to work under harsh environment. In this study, one-dimensional nanowires(NWs) of cubic phase silicon carbide(β-SiC) were efficiently produced by thermal chemical vapor deposition(T-CVD) synthesis of mixtures containing Si powders and hydrocarbon in a alumina boat about T = 1400 ℃. SEM images are shown that the temperature below 1300 ℃ is not enough to synthesis the SiC NWs due to insufficient thermal energy for melting of Si Powder and decomposition of methane gas. However, the SiC NWs are produced over 1300 ℃ and the most efficient temperature for growth of SiC NWs is about 1400 ℃ with an average diameter range between 50 ~ 150 nm. Raman spectra revealed the crystal form of the synthesized SiC NWs is a cubic phase. Two distinct peaks at 795 and 970 cm^{-1} over 1400 ℃ represent the TO and LO mode of the bulk β-SiC, respectively. In XRD spectra, this result was also verified with the strongest (111) peaks at 2Θ= 35.7°, which is very close to (111) plane peak position of 3C-SiC over 1400 ℃. TEM images are represented to two typical β-SiC NWs structures. One is shown the defect-free β-SiC nanowire with a (111) interplane distance with 0.25 nm, and the other is the stacking-faulted β-SiC nanowire. Two SiC nanowires are covered with SiO_2 layer with a thickness of less 2 nm. Moreover, by changing the flow rate of methane gas, the 300 sccm is the optimal condition for synthesis of a large amount of β-SiC NWs.