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Formation of Sn nanotemplate by Hot-wire Chemical Vapor Process on different substrates

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Abstract

We report here a primer on the formation of Sn nano-template by Hot-wire Chemical Vapor Process on different substrates namely Stainless steel (SS 304), polished Si wafer and corning glass. The morphology of the as-deposited Sn film is found to be different on different substrates. On SS substrate, interestingly, the as-deposited Sn film is a naturally grown template of Sn nano-particles without any annealing required whereas on Si wafer and glass substrates it is in a quasi-continuous film form of Sn rather than a well defined nano-template (well separated nano-particles) as in the former case. However, the as-deposited films on glass and Si wafer also turn into a defined template after annealing. It has been detected that all these Sn nano-particles are covered with a thin layer of SnO that has to be removed to enable the growth of SiNWs. Therefore, the morphology and the growth of SiNWs are found to be necessarily substrate dependent.

Keywords: Hot-wire CVP, Sn nano-template, stainless steel, silicon nanowires

Introduction

Uniform distribution and appropriate size of the metal nano-template or nano-particles are of significant importance for growing the SiNWs with well-controlled dimensions via VLS mechanism [1-3]. Hot-wire Chemical Vapor Process (HWCVP) grown SiNWs mostly have a core-shell structure [4]. The microstructure properties of the shell depend on the HWCVP parameters during SiNWs growth whereas the size of the core is governed by the size of used nano-template which can in turn be controlled by the thickness of the catalyst film or the annealing time. It is thus necessary to study the synthesis conditions of the Sn nano-template in