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Nucleation and growth of boron nanowires on diamond particles

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Abstract

Crystalline boron nanowires (BNWs) are grown on the entire surface of diamond powders by a solid-solid reaction approach. The as-grown BNWs have diameters in the range of 20-200nm, lengths of several micrometers. High-resolution transmission electron microscopy (HRTEM) observation indicated the boron nanowires are composed of two structures, the interior of the nanowire is well crystalline in hexagonal structure and the surface of the nanowire is covered by a 5-10nm thick tetragonal structure layer. Systematic analysis reveals that the conventional VLS (vapor-liquid-solid) growth model is not applicable to explain this kind of BNWs' growth mechanism. Hereby, an extended VLS model is proposed which can perfectly interpret the BNW's growth process on diamond surface and match experiment results very well.

Keywords: Diamond; boron nanowires; growth mechanism

1. Introduction

One-dimensional non-carbon materials have attracted intense attention because of the discovery of carbon nanotubes (CNTs) in the early of 1990s. As the nearest neighbor of carbon in the periodic table, Boron has extraordinary properties of high melting temperature, low density, good resistance to corrosion, as well as hardness closed to that of diamond [1]. Boron nanostructures thus are expected to have broad

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