【23-T03】

Growth model of carbon nanotubes using thermal chemical vapor deposition

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The chemical vapor deposition (CVD) method has attracted much attention because of the advantage that the growth of carbon nanotubes (CNTs) can be achieved with high purity, high yield, and vertical alignment. However, despite great progress in CVD growth of CNTs, the growth mechanism has still not been completely understood.

Given the different synthetic techniques, it is likely that a variety of mechanisms play a role in the growth of CNTs. Two growth models, *i. e.*, base growth and tip growth models, were proposed for the catalytic growth of carbon filaments. These growth models have been frequently adopted to explain the growth mechanism of CNTs.

We have grown vertically aligned multiwalled CNTs using thermal CVD. Reactant gas was C_2H_2 gas and catalyst were Fe and Co metal. The CNTs have clean surface without carbonaceous particles and are uniformly distributed on a large area substrate. High-resolution TEM analysis reveals that the multiwalled CNTs have the bamboo structure that the tube consists of hollow compartments separated with graphite layers. There is no encapsulated metal particle at the closed tip and compartment curvature are directed to the tip. Based on the experimental results, we propose a base growth model to explain the bamboo-shaped CNTs grown under our experimental conditions.