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Growth of vertically aligned carbon nanotubes on a large area Si substrates by thermal chemical vapor deposition

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Since the first observation of carbon nanotubes⁽¹⁾, extensive researches have been done for the synthesis using arc discharge⁽²⁾, laser vaporization⁽³⁾, and plasma-enhanced chemical vapor deposition⁽⁴⁾. Carbon nanotubes have unique physical and chemical properties and can allow nanoscale devices. Vertically aligned carbon nanotubes with high quality on a large area is particularly important to enable both fundamental studies and applications, such as flat panel displays and vacuum microelectronics. We have grown vertically aligned carbon nanotubes on a large area of Si substrates by thermal chemical vapor deposition using C_2H_2 gas at 750–950 °C. We deposited catalytic metal on Si substrate using thermal evaporation. The nanotubes reveal highly purified surface. The carbon nanotubes have multi-wall structure with a hollow inside and it reveals bamboo structure agreed with base growth model.

Figure 1 shows SEM micrograph showing vertically aligned carbon nanotubes which were grown at 950 °C on a large area (20 mm × 30 mm) of Si substrates. Figure 2(a) shows TEM analysis was performed on the carbon nanotubes grown at 950 °C for 10 min. The carbon nanotubes are multi-wall structure with bamboo shape and the lack of fringes inside the nanotube indicates that the core of the structure is hollow. In our experiment, carbon nanotubes grown by the thermal CVD indicate base growth model.

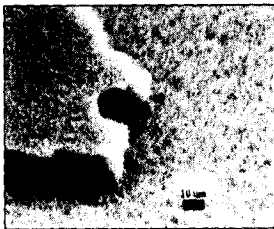


Fig. 1. SEM image of carbon nanotubes

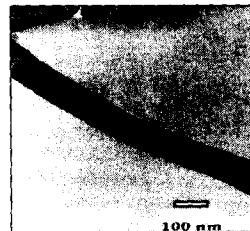


Fig. 2. TEM images of carbon nanotubes

Reference

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