

Comparison of carbon nanotube growth mode on various substrate

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Growth mechanism of carbon nanotubes(CNTs)synthesized by chemical vapor deposition is abided by two growth modes. These growth modes are classified by the position of activated catalytic metal particle in the CNTs. Growth mode can be also affected by interaction between substrate and catalytic metal and induced energy such as thermal and plasma. We studied the reaction of catalytic metal to the substrate and growth mode of CNTs.

Various substrates such as Si(100), graphite plate, corning glass, sapphire and AAO membrane are used to study the relation between catalytic metal and substrate in the synthesis of CNTs. For catalytic metal, thin film was deposited on various substrate via sputtering technique with a thickness of ~20nm and magnetic fluids with nono-sized particles were dispersed on AAO membrane. After laying process on AAO membrane, it was dried at 80°C for 8 hour. Synthesizing of CNTs was carried out at 900°C in NH₃/C₂H₂ mixture gases flow for 10 minutes.

We observed the diameter of grown CNTs is about 50nm with vertically aligned morphology and base growth mode on Si, glass and sapphire from FE-SEM characterization and HRTEM respectively. However, CNTs on membrane showed tip growth mode for its catalytic metal particles were positioned on the top side of tube from TEM study. Thus, the growth modes are depended on the substrates, especially reaction between catalyst and substrate. The base growth mode is dominant in the catalytic metal coated on plain substrate including Si wafer. But Tip growth mode is appeared in the magnetic fluids coated on AAO membrane. We synthesized CNTs with tip and base growth mode via thermal CVD method using various substrate and studied reaction of catalyst and substrate.

Keywords : Carbon nanotube (CNT); Growth mode