

CVD growth mechanism of single-walled carbon nanotubes from alcohol

Shigeo Maruyama, Yuhei Miyauchi, Yoichi Murakami, Shohei Chiashi, Erik Einarsson

The University of Tokyo

Contact e-mail: maruyama@photon.t.u-tokyo.ac.jp

By using alcohol as carbon source, high-purity single-walled carbon nanotubes (SWNTs) can be generated at relatively low CVD temperatures. Based on these findings, we have proposed the alcohol catalytic CVD (ACCVD) technique for bulk and vertically aligned synthesis of SWNTs. In addition to the conventional metal particles supported on zeolite, we have developed a simple dip-coat method to directly disperse nano-particles on flat substrates such as quartz and silicon. The vertically aligned SWNTs film with about 30 micron meters is grown on quartz substrates by employing the most efficient activation of catalytic metals. In addition to molecular dynamics simulations, various experimental techniques have been employed to understand the growth mechanism of SWNTs: direct TEM observation of catalysts particles; in-situ Raman and AFM measurements during CVD; in-situ monitoring of laser absorption; combinatory sputtering method to prepare catalysts. The chirality distribution of SWNTs measured by the near infrared fluorescence spectroscopy is quite unique for low-temperature ACCVD condition. The near armchair nanotubes are predominantly generated probably because of the stability of nanotube cap structure.