Controlled Growth of Single-Walled Carbon Nanotubes Using the Alcohol CVD Method

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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 alcohol catalytic CVD (ACCVD) technique. Using a simple dip-coat method to directly disperse nano-particles on flat substrates, the vertically aligned SWNTs film with up to 20 micron meters is grown on quartz substrates by employing the most efficient activation of catalytic metals.

On the other hand, the chirality distribution of SWNTs measured by the near infrared fluorescence spectroscopy is quite unique for low-temperature CVD condition. The near armchair nanotubes are predominantly generated probably because of the stability of nanotube cap structure. The infrared fluorescence is strong enough to be observed from individual nanotubes on a silicon substrate.

The anisotropic optical properties of SWNTs can be intensively studied with the vertically aligned SWNTs or aligned individual SWNTs with gelatine matrix. Polarized resonant Raman and polarized optical absorption studies of vertically aligned SWNTs clearly shows the anisotropic optical properties of nanotubes. Applications of SWNTs in optical devices such as polarizer and saturable absorbers for mode-locked fiber lasers are expected.