2:30 PM - EE10.3

Density-controlled Growth of Horizontally Aligned Single-walled Carbon Nanotubes on Crystal Quartz Substrates

Shohei Chiashi1, Taiki Inoue1, Daisuke Hasegawa1, Shigeo Maruyama1.

1, , The University of Tokyo, Tokyo, Japan.

The direction control is one of the most important growth techniques of single-walled carbon nanotubes (SWNTs). Especially, horizontally aligned SWNTs is necessary for SWNT electronic applications and it is required to increase the density of the aligned SWNTs. In order to enhance the density of the aligned SWNTs, we investigated the growth conditions. SWNTs were synthesized by using chemical vapor deposition (CVD) method. Ethanol vapor, iron (Fe) particles and R-cut (101) quartz were used as the carbon source, the catalyst and the horizontally alignment substrates. Fe was deposited in line shape on R-cut quartz substrates. The Fe line width was 2 Î¼m and the CVD temperature was 800 Â° C. SWNTs were grown from the Fe catalyst particles, which formed in the catalyst line area, and some of them ware aligned on the surface of the quartz substrates. At higher ethanol pressure, the growth amount of SWNTs increased in the catalyst area, while they were entangled and most of them were not aligned on quartz substrates. On the other hand, at lower pressure of ethanol, the amount of grown SWNTs decreased in the catalyst area. However, it was found that the number of horizontally aligned SWNTs increased. The lower pressure might decrease the growth rate and increase the incubation time, which is a waiting time before starting to grow. When the incubation time is long, the two contiguous and growing SWNTs hardly contact to be entangled. The lower gas pressure prevented the entanglement of SWNTs, which resulted in enhancement of the density of horizontally aligned SWNTs