# Generation of SWNTs by Floated CCVD Method from Alcohol

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Alcohol is proved to be an excellent carbon source for SWNTs in the supported catalytic CVD (CCVD) method, because it can produce SWNTs at low temperature and without side-products [1, 2]. Furthermore, alcohol can also produce SWNTs in the floated CCVD process using ferrocene, which generates iron clusters as catalyst particles [3]. Through the optimization of the floated CCVD process [3], higher yield of SWNTs product was achieved by considerably decreasing gas flow velocity and by employing argon carrier gas. The ferrocene ethanol mixture gas (Fe content was about 0.06 wt %) was lead into the quartz tube, which was heated with the electric furnaces at about 900 °C and evacuated by the rotary pump in advance. Keeping the pressure of ethanol gas at about 300 Torr and gas velocity at 1~10 cm/s, the products were collected by the membrane filter at the downstream. The Raman scattering spectra and TEM image as shown in Fig. 1 showed that quite high purity SWNTs were produced with small amount of amorphous carbon. The TGA results shown in Fig. 2 show that about half of the initial mass was SWNTs. This yield is similar to the HiPco sample (batch #: HPR113.4) supplied from Rice University. The amount of iron particles was almost the same as HiPco sample from the TEM observations and TGA. It seems that iron particles were much weakly incorporated to SWNT walls in our sample as shown in the higher burning temperature in Fig. 2. On the other hand, floated ACCVD sample has some amorphous carbon at this optimization stage.

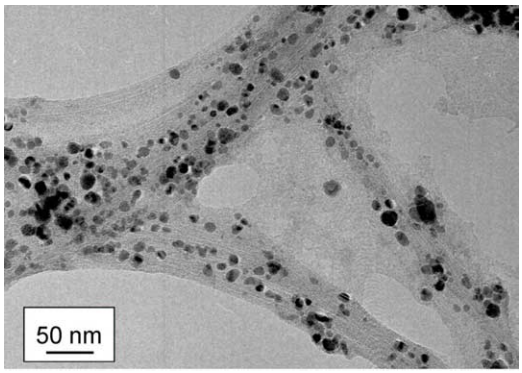


Fig. 1 TEM image of SWNTs at 900 °C, V = 1 cm/s.

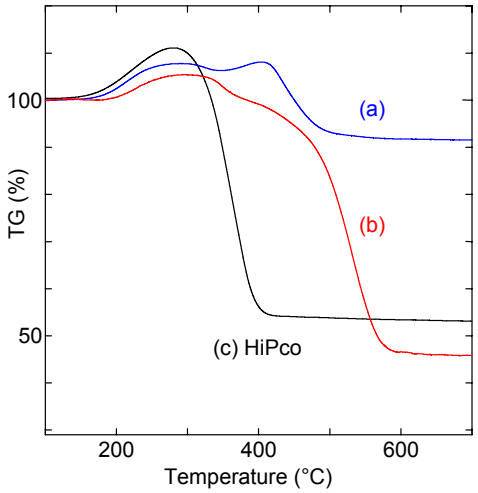


Fig. 2 TGA profiles of samples at 900 °C, (a) V = 4 cm/s, (b) V = 1 cm/s, and (c) HiPco sample.

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[3] S. Maruyama *et al.*, 24th Fullerene Nanotubes General Symp., (2003) p. 22.

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