

Effect of flow rate of ethanol on growth dynamics of VA-SWNT - Transition from no-flow CVD to normal ACCVD –

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Towards selective growth of SWNTs, it is important to know their growth mechanism. In previous studies, using optical absorbance technique, we have monitored the growth of vertically aligned single-walled carbon nanotubes (VA-SWNTs) [1] and obtained profiles of the VA-SWNT thickness with respect to the growth time, which was analyzed by suggesting a growth model [2].

In this study, the flow rate of ethanol during the CVD was controlled precisely. Figure 1 shows the growth curve of VA-SWNT film for various ethanol flow rates. In the figure, “No-flow” indicates that the supply of ethanol was stopped by sealing off the chamber during the reaction, when CVD was started. Normally, ACCVD is operated at flow rate of several hundred sccm. In that case, the growth rate of SWNT film decreases exponentially. On the other hand, for lower flow rate, the growth rate does not decrease with time and even increases in the case of 5sccm and 10sccm. However, after VA-SWNT film reaches certain thickness, the growth stops suddenly. The trend reflects the effect of ethanol decomposition in the growth mechanism of VA-SWNT using ACCVD method.

[1]. S. Maruyama, E. Einarsson, Y. Murakami and T. Edamura, Chem. Phys. Lett.403 (2005)320.

[2]. E. Einarsson, Y. Murakami, M. Kadowaki and S. Maruyama, Carbon, (2008).

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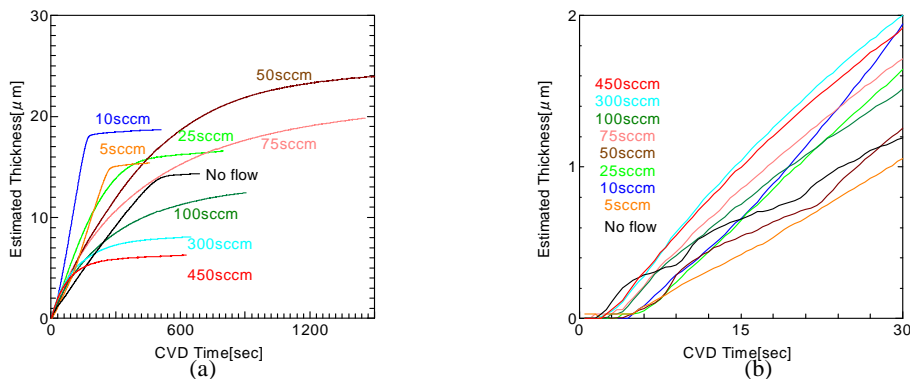


Fig. 1 Growth curve of VA-SWNT for different flow rate. (b) is a magnification of initial 30 s.