Characterization of growth process of VA-SWNT films and their applications for Dye-Sensitized Solar Cell

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Towards the application of SWNTs, clarification of their growth mechanism and control of their diameter, alignments and chirality is important. For these purposes, we firstly investigated the growth process of vertically aligned SWNTs (VA-SWNTs). We have monitored the growth of VA-SWNT films using optical absorbance technique [1] and obtained the growth curves of these films. Variation of growth profiles was observed when the flow rate of ethanol during the ACCVD [2] was controlled precisely (Fig. 1). Furthermore, careful consideration was given for these outcomes by comparing with the results of CHEMKIN simulations and FT-IR gas analysis.

Secondly, as an example of the applications, we attempted to use VA-SWNT films as counter electrodes (CEs) for dye-sensitized solar cells (DSCs). Although platinum has been popularly adopted as a catalyst on CEs, it is rare and expensive. Hence, there is a strong demand for new materials for CEs. By detachment technique of SWNT films from substrates [3], the film was transferred on a transparent conductive oxide (TCO) substrate to form a CE. Figure 2 shows the I-V characteristics of DSCs using Pt and SWNT films. Even though the fill factor of the cell with SWNT was smaller than that with Pt, the similar short circuit current (Isc) and open ciruit voltage (Voc) was obtained. Smaller fill factor may be caused by the contact resistance between the SWNT film and TCO. Although this problem needs to be solved, current result indicates SWNT films can be useful as a material of CEs.

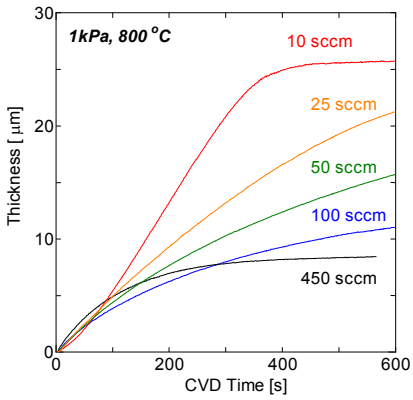

Fig. 1 Growth curve of VA-SWNT for different flow rates.

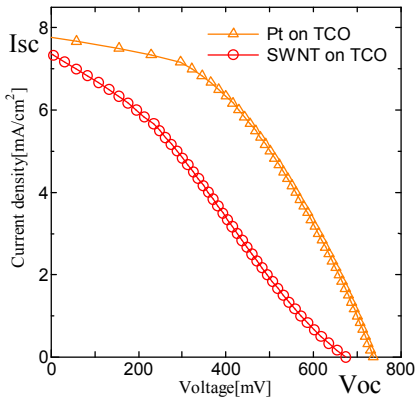

Fig. 2 I-V characteristics of DSCs with Pt and SWNT CEs.

[1] S. Maruyama *et.al., Chem. Phys. Lett.***403** (2005) 320

[2] S. Maruyama *et.al., Chem. Phys. Lett.***360** (2002) 229

[3] Y. Murakami and S. Maruyama, ,*Chem. Phys. Lett.***422** (2006) 575

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