Catalytic CVD Generation of SWNTs on Silicon Surface from Alcohol

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The controlled synthesis of single-walled carbon nanotubes (SWNTs) on a Si substrate is currently being pursued using the alcohol catalytic CVD (ACCVD) process [1] that was developed by our group. In the earliest stage, a droplet of solution of iron acetate and cobalt acetate solution was deposited on Si substrate; however, this approach so far necessarily resulted in only multi-walled carbon nanotube (MWNT) yields.

This preliminary experiment implies that an appropriate support structure for the catalytic metal is essential for the controlled growth of SWNTs on a solid surface. As one approach based on this idea, we employed a mesoporous silica (MPS) film that consists of 6 nm (typical) periodic pore structure. Preparation of the mesoporous silica film obeyed that presented in [2]. With this method, SWNTs were synthesized on the MPS-coated Si substrate with ethanol as a carbon source at 750 deg C (Fig .1). The micro Raman spectrum of the Si substrate after ACCVD (Fig. 2) shows the existence of SWNTs on the Si substrate.

Further experiments are currently in progress in order to elucidate an optimum synthesis condition. Detailed results will be presented at the symposium.

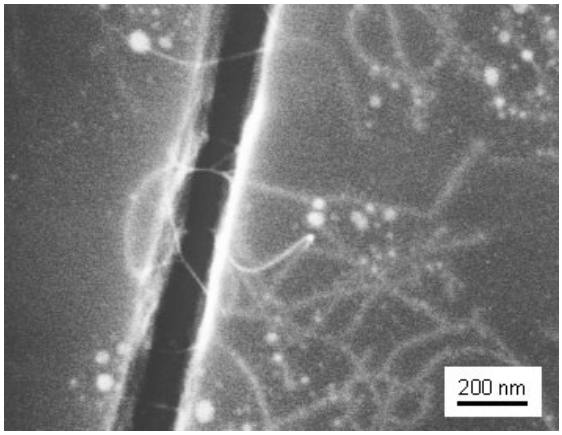

Fig. 1 SWNTs grown on Si substrate coated with MPS film. The vertical trench is a cleavage of the film, over which SWNTs are seen to pass through.

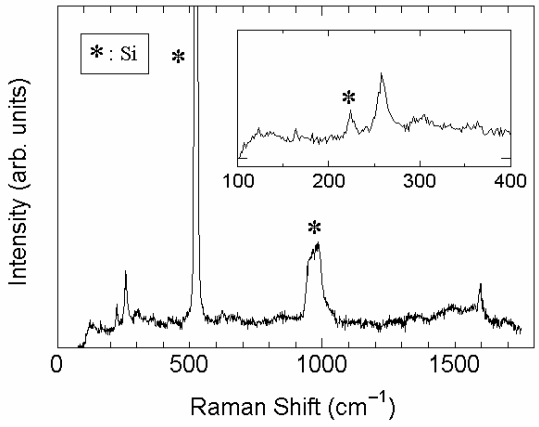

Fig. 2 Micro Raman spectrum (Laser: 488 nm) of the Si substrate after ACCVD at 750 deg C. Inset emphasizes the low spectra area, showing a peak of SWNT breathing mode at 257 cm^{-1}.

[1]S. Maruyama *et al.*, *Chem. Phys. Lett.*, **360** (2002) 229-234.

[2]D. Zhao *et al.*, *Adv. Matar.,* **10**-16, (1998), 1380-1385.

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