Direct Synthesis of High-Quality SWNT Mat on Silicon and Quartz Substrates

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A new technique of synthesizing high-quality SWNTs directly on the surfaces of Si and quartz substrate was developed with employing the alcohol catalytic CCVD method [1, 2]. The proposed method features a unique liquid-based dip-coat approach for the mount of metal catalyst, where a piece of substrates was vertically drawn-up from Mo/Co acetate solution (0.01 wt%) at a constant speed of 4 cm/min [3].

Fig. 1 shows the Raman spectra of SWNTs directly grown on Si and quartz substrates where the CVD reaction times were 10 and 60 minutes, respectively. From Fig. 1(a) to (c), the ratio of G-band peak to Si peak around 960 cm^{-1} approximates the amount of produced SWNTs. Abundant amount of high-quality SWNTs were synthesized on Si surface in the case of 800 °C, and smaller amount of SWNTs were produced even at 650 °C that is by far the lowest among the past reports.

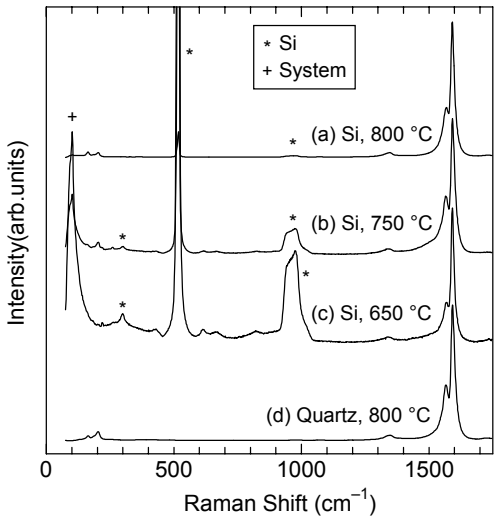

Fig. 1 Raman spectra (Laser: 488nm) of SWNTs grown directly on the Si and quartz substrates under different CVD temperatures.

Fig. 2 exhibits a SEM image of a SWNT mat (estimated thickness: 200 ~ 300 nm) uniformly formed on a quartz substrate corresponding to Fig. 1(d). The SWNTs were abundantly generated to the extent they can be mechanically scratched off from the surface. The optical absorption of 'as-grown' SWNTs was first measured using thereby obtained blacked quartz substrate.

This technique could lead to novel applications of SWNTs in optical and sensing devices based on silicon or quartz systems.

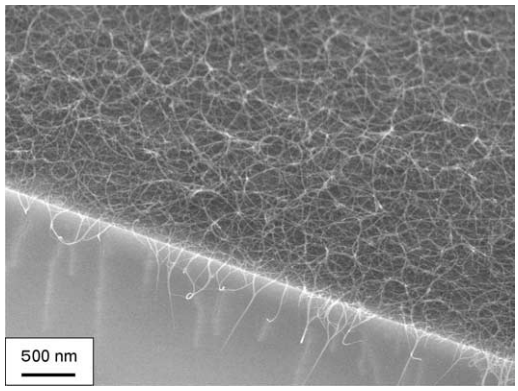

Fig. 2 Tilted-angle SEM image of SWNT mat directly formed on a quartz substrate. Lower half is the broken cross-section of the substrate.

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

[2] Y. Murakami *et al.*, *Chem. Phys. Lett.*, **374** (2003) 53-58.

[3] Y. Murakami *et al.*, *Chem. Phys. Lett.*, submitted.

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