

In-situ Observation of Raman Scattering of SWNTs during ACCVD Process

Shohei Chiashi, Yoichi Murakami, Yuhei Miyauchi and Shigeo Maruyama

*Department of Mechanical Engineering, The University of Tokyo
7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan*

In-situ observation of Raman scattering of SWNTs in the growth stage was performed using the alcohol catalytic CVD (ACCVD) method. Fig.1 shows an AFM system with Raman scattering measurement capabilities. By using this experimental apparatus, in-situ Raman scattering observation was performed during the generation of SWNTs[2].

Fe/Co metal particles supported with zeolite were dispersed on a silicon plate, which was located inside a vacuum chamber. After evacuating the chamber, an AC voltage (about 6 V) was supplied to the silicon plate, which was heated by Joule heating ($R \approx 5 \Omega$). Ethanol gas was then introduced into the chamber. The reaction temperature was approximately 800 °C, and the pressure was 1.0 Torr.

Fig. 2 shows Raman scattering by SWNTs during the ACCVD process. There is only one silicon peak (at 521 cm^{-1}) (spectrum (a)), which shifted and decreased in intensity when heated (spectrum (b)). The G-band peak from SWNTs appeared around 1560 cm^{-1} , after supplying ethanol gas (spectrum (c)). During CVD (spectra (c) to (g)), the intensity of the G-band gets larger and larger, while that of silicon is almost constant. After stopping the flow of ethanol gas and cooling, the intensities of both the G-band and the silicon peak increased, and their peaks were upshifted rapidly due to the decrease in temperature (spectrum (h)).

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

[2] S. Chiashi *et al.*, *Chem. Phys. Lett.*, submitted.

Corresponding Author: Shigeo Maruyama
E-mail: maruyama@photon.t.u-tokyo.ac.jp,
Tel/Fax: +81-3-5800-6983

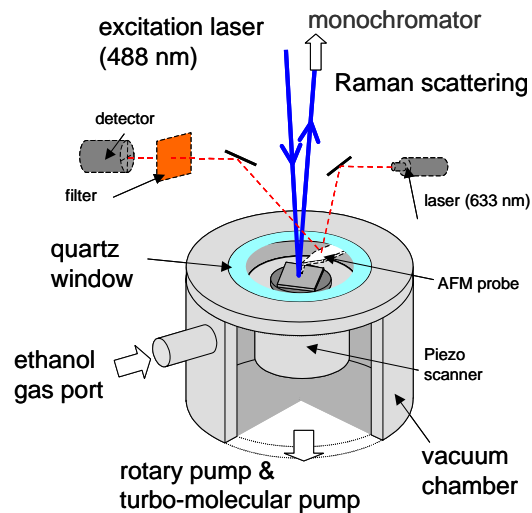


Fig. 1 An AFM system with Raman scattering measurement capabilities.

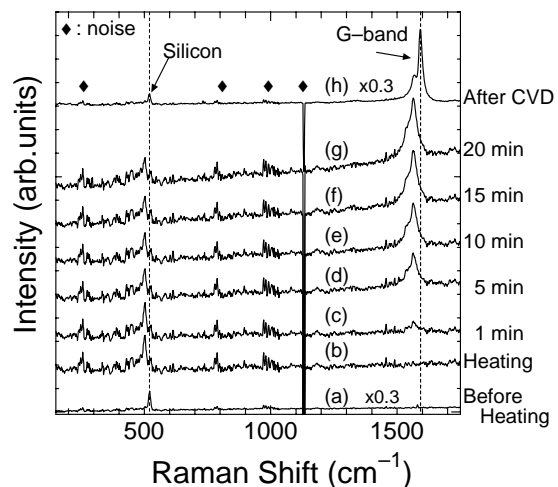


Fig. 2 Raman scattering by SWNTs during ACCVD process.