

CARBON NANOTUBES FORMATION ON THE SURFACE OF DIAMOND FILM STUDIED BY INSITU RAMAN SCATTERING

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In-situ Raman scattering were performed to examine the carbon nanotube formation process on the surface of diamond films. Diamond film was synthesized by MPECVD, and then a thin layer (~10 nm thick) of metal catalyst, Fe_{0.8}Co_{0.2} alloy, was coated by using the DC sputtering process[1]. Raman spectra were measured in-situ during the heating of FeCo-coated diamond films from room temperature to 900 °C. The procedure of in-situ Raman measurement was described in Ref. [2].

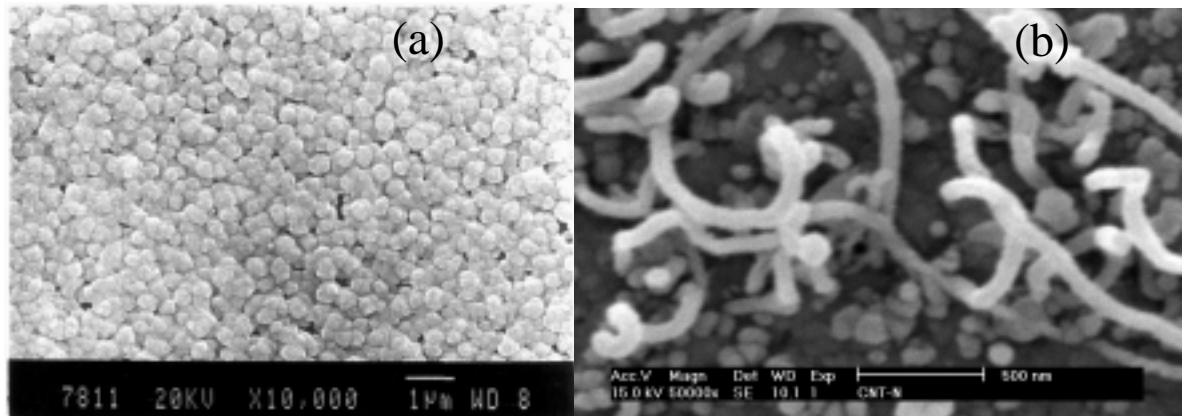


Fig 1. The SEM image of Diamond films (a) before and (b) after thermal annealing at 900 °C. The carbon-nanotube can be clearly seen after annealing treatment.

The SEM image of as-grown diamond film is shown in Fig. 1(a). After the thermal annealing treatment, as shown in Fig. (b), we found the carbon nanotubes grown out of the film surface. The ex-situ Raman spectra taken at room temperature of both films shown in Fig. 1(a) and (b) is plotted in Fig. 2 (a) and (b). The strong second order signal is a clear indication of the existence of carbon nanotubes[3]. The diamond peak of the

as-prepared diamond film at 1331 cm^{-1} was found in Fig. 2(a), and the cause of weak signal is due to the Fe-Co coating and the presence of the graphitic structure.

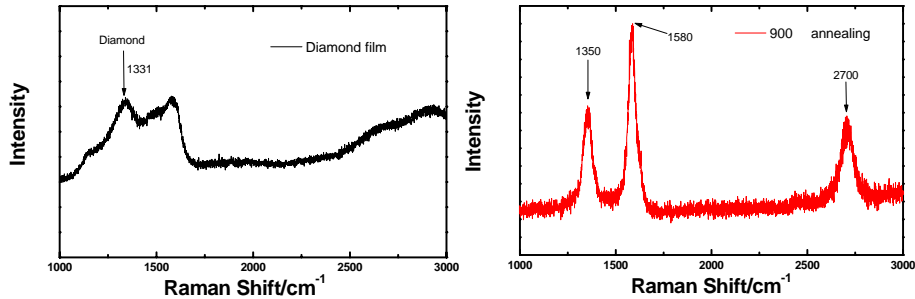


Fig 2. The ex-situ Raman spectra of both films taken at room temperature. (a) is before and (b) is after thermal annealing at $900\text{ }^{\circ}\text{C}$. The phonon peaks are also indicated.

The in-situ Raman scattering were performed in a UHV chamber (10^{-8} torr). Sample was annealed at temperature from room temperature to $900\text{ }^{\circ}\text{C}$. The Raman spectra are shown in Fig 3. We found that the appearance of the nanotube is at temperature around $700\text{ }^{\circ}\text{C}$.

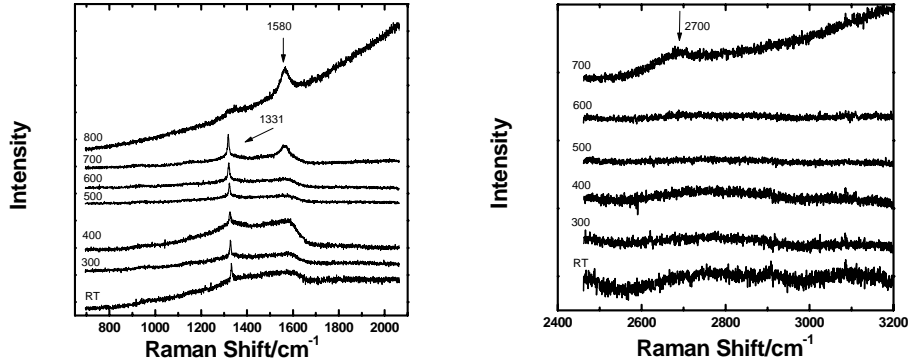


Fig. 3. In situ Raman spectra of the annealed diamond film. At $700\text{ }^{\circ}\text{C}$, the second order Raman start to grow.

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2. C-L Cheng, C-T Chia, C-C Chiu, C-C Wu and I-N Lin, *Diamond Relat. Mater.* 10 970 (2001).
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