Further Identification of 1150 cm\(^{-1}\) Raman Peak in MPCVD Diamond Film

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Abstract: The 1150 cm\(^{-1}\) Raman peak in diamond films prepared by CVD are studied. Through heating treatment, result on a typical sample reveals the correlation between this peak and another. Further research on series samples confirms the assignment.

Raman technique has been used in analyzing the component and crystallographic property of MPCVD diamond thin film (DTF) \([1]\). Four DTF samples which are grown on crystal silicon substrate with MPCVD are involved in this abstract. They are labeled A, B, C and D with the average grain size is less than 10 nm and 30 nm for A and B, respectively. Grains of both C and D are in \(\mu\)m scale and good crystalline structure. In Raman spectrum of sample B, as shown in Fig. 1, there are 7 peaks, in which the #2 peak corresponds to a maximum value of the density of states of diamond \([2]\), #3, #4, #6 and #7 peaks are originated from crystal diamond, disordered carbon (D mode), graphite (G mode) and disordered carbon, respectively. Recently, the #1 peak was found to be contributed from trans-Polyacetylene (TPA)\([3, 4]\) , although it was thought as proof of the presence of nano-crystalline diamond for a long time \([1]\).

![Fig. 1 Raman spectrum of DTF sample B with the fitting result.](image_url)

We find a consistent behavior of the #1 and #5 peaks and assign the former to single c-c bond and the later to double c=c bond of TPA\([5]\). Shown as Fig 2, with heating treatment of up to 500°C, no transformation happens but when the temperature reaches 600°C neither the #1 peak nor the #5 peak can be seen while the diamond peak remains. It is clearly that these two peaks do not belong to diamond and have same origin.

Fig.3 shows the Raman spectra of sample A, B, C and D measured at 515nm excitation. From Fig 3 we can see in all of samples that the peaks #1 and #5 with greatest intensities is found in the
samples C and D of µm scale, the peaks with second intensity in the sample B with 30nm size and in the sample D with the grain size less than 10 nm both peaks #1 and # 5 disappears. This result further confirms the correlation between the peaks #1 and #5 and no-correlation of peaks #1 to the nano-material [6].

Fig. 3 Raman spectra of A,B, C and D measured at 515nm excitation

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