Preparation of crystalline carbon films by Photo-CVD*

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Polycrystalline carbon films were prepared by photo-decomposition of acetylene under irradiation of UV light from the low pressure Hg lamp. The samples were characterized by electoron beam diffraction and scanning electoron mycroscope (SEM). The substrate temperature above 300°C were necessary for obtaining polycrystalline carbon films.

Recently, a great deal of attention has been forced on diamond or hard carbon films. These films have been obtained by thermal chemical vapour deposition (thermal CVD), plasma-enhanced chemical vapour deposition (Plasma CVD). Few papers have been described about carbon films deposited by photo-assisted method. In those studies, carbon films had amorphous structure. In this paper, polycrystalline carbon films were prepare by direct photo-decomposition of acetylene.

1. Experimental

The apparetus used in this work is shown schematically in Fig. 1. Films were prepared by photo-decomposition of acetylene. Low pressure Hg lamp was used as an irradiation source. The chamber was evacuated by a convertional rotarypumped sysem. During deposition, the pressure in the chamber was 3-5 Torr. The gas flow rate was 200 sccm. Deposition time was 10 hours. Glass (Corning 7059) was used as the substrate. Films were deposited at temperature of 100-500°C.

2. Experimental Results and Discussion

The structure of the films were chracterized by transmission electorn beam diffraction. Fig. 2 shows diffraction patterns of carbon films deposited at 100°C 300°C and 500°C. The sample prepaerd at 100°C seemed to have amorphous structure, because the diffraction pattern for this films showed only diffused rings.

Clear rings were observed in the diffraction pattern for the samples prepared above 300°C. These rings corresponded to the pattern of hexagonal carbon (graphite).

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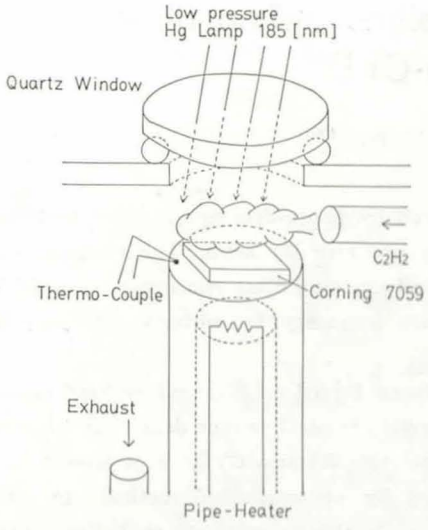

Fig. 1 The diagram of photo-CVD apparatus

Table 1 The characteristics of carbon fflms

Substrate Temperature	the electron diffraction patterns
100 °C	amorphous
300 °C 500 °C	polycrystalline

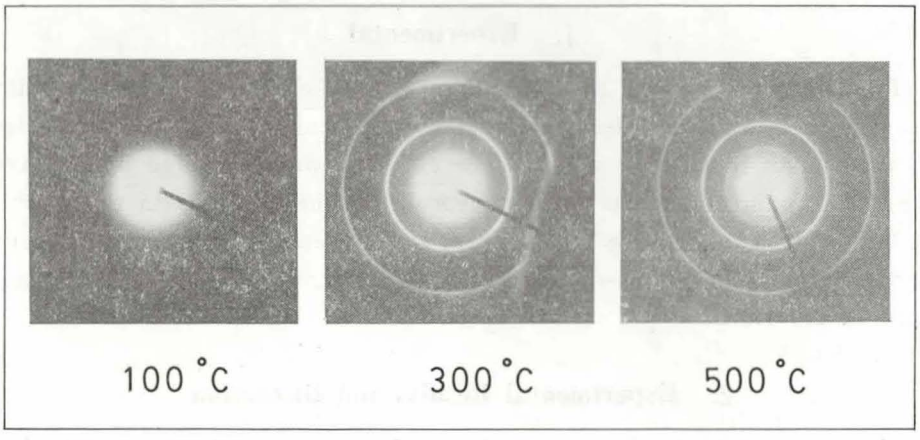

Fig. 2 The transmisson electron diffraction patterns of carbon films

These films seemed to be consist of polycrystalline carbon films.

The diffraction ring became more clear when the deposition temperature increased.

Hanabusa and his coworker also have reported he results about carbon films prepared by phot-CVD.

Surface mophology were observed by SEM. Fig. 3 shows the SEM image of the samples. No obvious pattern was observed in the SEM image of the sample prepared at 100°C. Granular patterns appeared in the SEM images of the samples prepared at higher than 300°C. The size of the Granular pattern

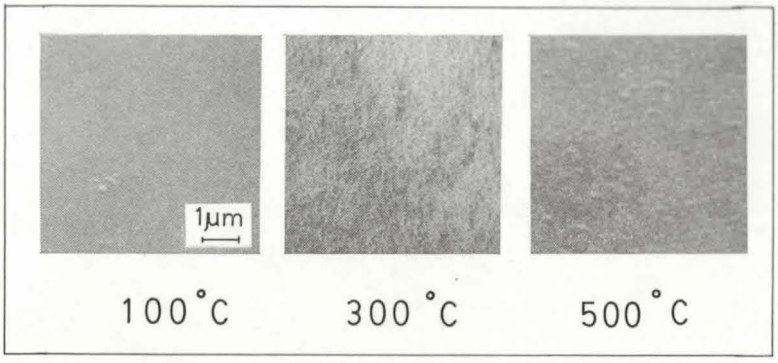

Fig. 3 The SEM image of carbon films

seemed to increase when the samples were prepared at higher temperature. These results correspond to the results of the diffraction mesurements.

3. Conclusions

Polycrystalline carbon films have been deposited by photo-decomposition of acetylene under irradiation of UV light from low pressure Hg lamp.

Characteristics of these samples are listed in Table 1. Polycrystalline films were obtained when they were prepared at higher than 300°C.

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