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Preparation and Characterization of DLC Films on Si-wafer using Organic Compounds by PECVD

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It is not clear about the growth mechanism for diamond in the vapor phase. However, it is reported that methyl radical with sp^3 hybrid orbital and atomic hydrogen were likely to do important roles in the synthesis of the diamond.

Recently It has been shown that incorporating O and/or OH into the source gases has several beneficial effects, including improved film quality, lower deposition temperature and enhancement in etching of non-diamond phases in the deposition process. Which is simply explained by the increase in the atomic hydrogen and the active intermediate species containing oxygen. Further more, these active species promote the etching of the non diamond phase.

At present, however, the role of oxygen on film crystallinity and the reaction process between oxygen and other species in the plasma discharge area are not yet throughly understood.

It is well known that, in most cases of CVD, pretreatment of the substrate was required in order to obtain a high quality diamond film , and that the pretreatment with abrading diamond powders is effective to the nucleation and deposition of the diamond.

In these experiments, most of the surfaces of Si-wafers as substrates were prepared by polished with diamond paste and at the same time H_2 etching were done in order to enhance the nucleation density on the substrates.

We used methanol and acetone as precursors to obtain methyl radicals and OH radicals easily in the PECVD condition, and made an effort to find whether the OH radicals can effect the same role of oxygen gas mixture or not.

In order to get optima conditions, the diamond-like carbon films are deposited as a function of deposition parameters such as concentrations of organic compounds in reaction chamber, reaction pressures, deposition times and pretreatment methods.

To investigate the nature of DLC films, we took advantages of the SPEX 1403 double monochromator Raman spectrometer with 514.4 nm Ar laser, Philips X-ray diffractometer and Hitachi S-2500C Scanning Electron Microscopy.