

## Investigation of Deposition Process of Amorphous Carbon Film

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### Abstract

The dependence of the deposition process of amorphous carbon films on growth temperatures has been investigated by using infrared spectroscopy in multiple internal reflection geometry (MIR-IRAS). The CH<sub>3</sub> peak of amorphous carbon film was decreased as the growth temperature was increased.

**Keywords:** amorphous carbon film; deposition process; hydrogen; infrared spectroscopy

### Introduction

An amorphous carbon film has been a promising material because it has unique properties such as mechanical hardness, chemical inertness, bio-compatibility, and changeable electrical property. To optimize the film properties, it is important to control the film deposition process. Hydrogen plays an important role in the deposition process. Then, behavior of hydrogen in a film has to be investigated. We have investigated the hydrogen behavior by using infrared spectroscopy in multiple internal reflection geometry (MIR-IRAS).

### Experiments

An IRAS monitoring system was installed into a PECVD reaction chamber equipped with a RF plasma

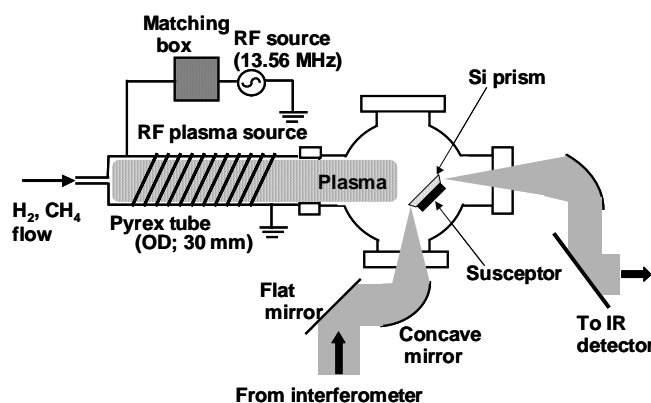


Fig. 1 Experimental setup

source, a sample holder made of copper and gas delivery system [1]. The base pressure of the chamber was maintained below  $2 \times 10^{-6}$  Torr. Plasma was generated by applying a 13.56 MHz RF power through a  $\pi$ -type matching network to a coil wrapped around a glass tube with a diameter of 3 cm; molecular hydrogen and methane gases were fed through this tube to the vacuum chamber. The 11-turn coil antenna had a length of approximately 11 cm and was placed at a distance of 20 cm from a Si sample.

### **Results and Discussions**

Infrared spectra showed that the relative density of the CH<sub>3</sub> species was decreased in the film with the density of the CH and/or CH<sub>2</sub> species, as the growth temperature was increased from room temperature to 200 degree C. To clarify this phenomenon, the thermal stability of the CH<sub>x</sub> species was investigated. This result showed that the CH<sub>x</sub> species in film was stable against the thermal annealing up to 300 degree C. Then, we consider it is attributed to the interaction between hydrogen and amorphous carbon films during the film deposition. We investigated the interaction and its temperature. We will discuss the results and the growth process of the amorphous carbon film.

### **Conclusions**

The relative density of the CH<sub>3</sub> species was decreased in amorphous carbon film, as the growth temperature was increased. We will discuss its cause and the growth process of the amorphous carbon film.

### **References**

1. M. Shinohara, T. Kuwano, Y. Kimura, M. Niwano, *Thin Solid Films*, **475**, 128–132 (2005).