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Development of a Plasma Source for Deposition of Charge Exchange Carbon Foil

荷電交換用カーボンフォイル蒸着のためのプラズマ源開発

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1. Introduction

Nano crystalline diamond thin films can be a durable carbon stripper foil for a high energy accelerator ring against continuous proton irradiation. An electron cyclotron resonance (ECR) plasma forms the condition suitable for plasma enhanced chemical vapor deposition (PECVD) to prepare a nano crystalline diamond film. In the meantime, μ-wave plasma can realize boron doping into a nano diamond film by sputtering solid boron surface due to self-bias effect. In this study, the electron density and temperature for different configurations of carbon antenna exposed to a hydrogen plasma were investigated.

2. Experimental apparatus

Figure 1 shows the schematic diagram of the ECR plasma apparatus: (a), and the photograph of a carbon antenna with the electrical power feed terminal located at the center of a vacuum flange: (b). An solenoid coil creates a magnetic field around the region of the antenna to realize ECR condition. The ECR condition, or 875G magnetic field intensity is obtained around the electrode by supplying 80 A electrical current to the solenoid coil. A Langmuir probe 0.5 mm diameter 330 mm long W made characterized the properties of the plasma at the location 15cm distant from the antenna. Figure 2 (a) and (b) show dependences upon the magnetic field of electron density and temperature, respectively. The electron density was found lounger below the ECR condition. Part of the reason for measuring higher density at lower field intensity can be due to inhomogeneity of the plasma, which was confirmed by the plasma glow observed from a side window port.

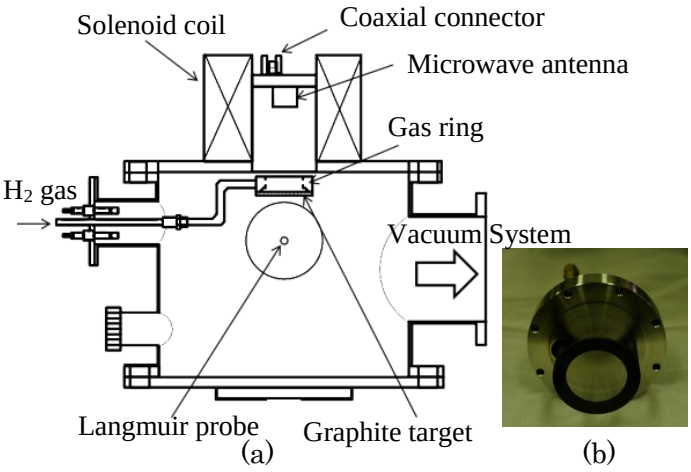

Fig.1 (a) Schematic diagram of ECR plasma apparatus. (b) Photograph of a carbon antenna with flange.

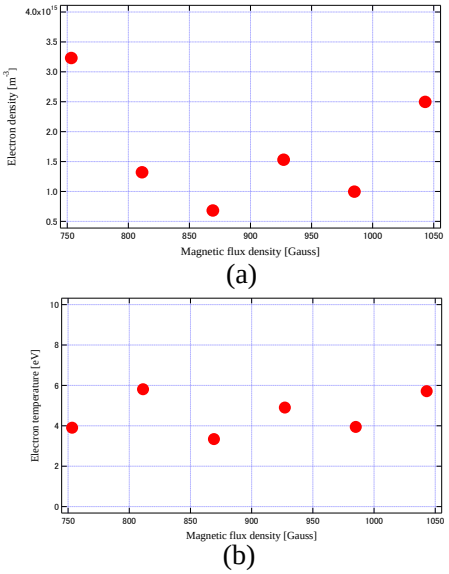

Fig.2 Coil current characteristics of electron density (a) and electron temperature (b)