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150 kHzバーストICPのグローバルモデル解析
Global Model Analysis of 150 kHz-Band High-Power Pulse Burst Inductively Coupled Plasma

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Introduction

As plasma sources, inductively coupled plasma (ICP) has been widely used for material processing because of its advantages [1]. A high power pulsed ICP system driven with frequency of 100-200 kHz was developed to generate a high density plasma [2]. In this study, calculation results of the pulsed ICP generated by high power input are shown. Electron temperature and plasma density calculated using global model are compared with results of double-probe measurement [3].

ICP generation system

Fig. 1 shows a schematic of ICP generation system. The vacuum chamber consists of six glass tubes. A solenoid coil of 84 μH is wound on the glass tube. Parallel resonance circuit consist of the coil and the capacitor of 12 nF connected to the coil in parallel. A 200 μs wide burst of 157 kHz power supply is employed to generate ICP with repetition rate of 1 Hz. Argon gas is supplied through a mass flow controller into the chamber. Pressure inside the chamber is fixed at the range of 1-14 Pa. Power absorption to the plasma is in range of 1.8-7.9 kW.

Results

Fig. 2 shows the plasma absorbed power dependence of (a) electron temperature and (b) plasma density with respect to the pressure. The global model calculation results are obtained from the plasma absorbed power based on the coil voltage and current. The experimental values are measured by using double-probe at the position 30 mm away from the coil end. The characteristics of electron temperature and plasma density shows that the calculated and experimental values have similar tendency with respect to the absorbed power and the pressure. The electron temperature is obtained as 1.8-3.3 eV. The plasma density is on the order of 10^{19}-10^{20} m^{-3}.

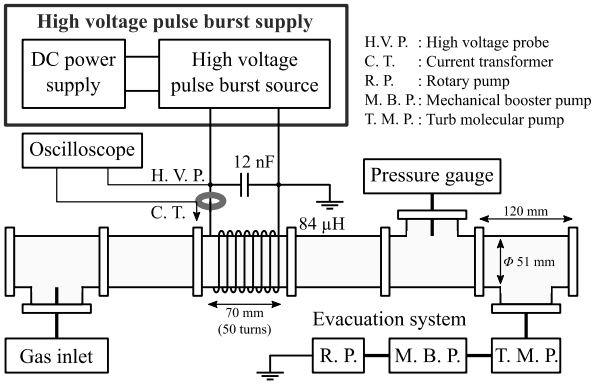

Fig. 1 Schematic of ICP generation system

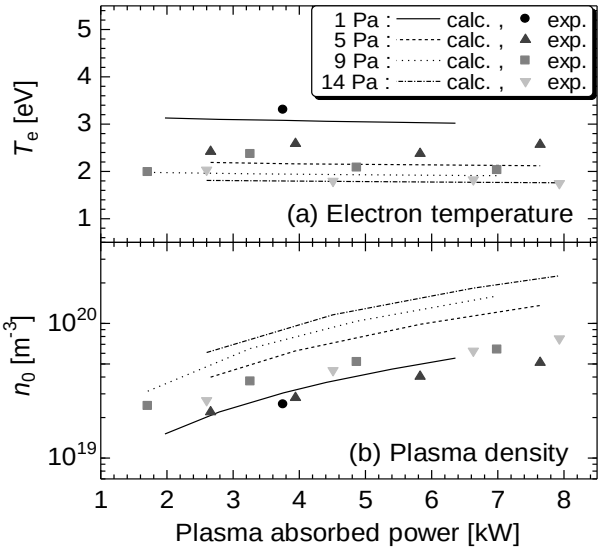

Fig. 2 Plasma absorbed power dependence of (a) electron temperature and (b) plasma density with respect to gas pressure.

References

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