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トムソン散乱法を用いた 450 MHz 極超高周波プラズマの電子密度・温度の 2 次元分布計測

Measurement of Two-dimensional Profiles of Electron Density and Temperature of 450 MHz Ultra-high Frequency Plasma Using Laser Thomson Scattering

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To understand plasma processing using high-frequency capacitively coupled plasma (CCP) sources, precise measurements of these plasma parameters, such as electron density (n_e) and electron temperature (T_e), are prerequisite [1]. Here, we report two-dimensional profiles of n_e and T_e in CCP with an ultra-high frequency (450 MHz) power source using laser Thomson scattering (LTS) technique.

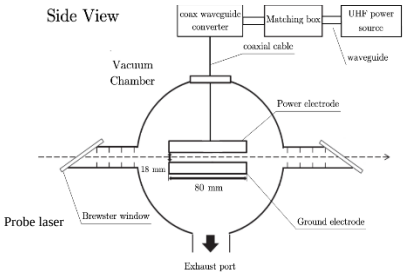

Fig.1 Schematic diagram of the experimental setup.

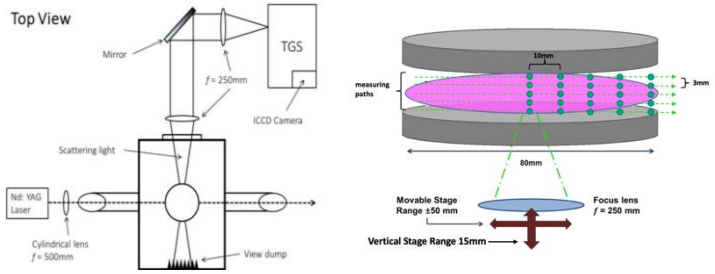

Fig.2 Schematic diagram of 25 measuring positions

Figure 1 shows the experimental setup. The parallel plate electrodes (diameter 80mm, gap 18mm) were installed in the vacuum chamber. The upper power electrode was connected with a 450MHz power supply (output power 160 W), and 400,200,100,50 mTorr argon gas was sequentially introduced into the vacuum chamber. As shown in Fig, for 2D LTS measurements, we chose 25 points as the measurement positions.

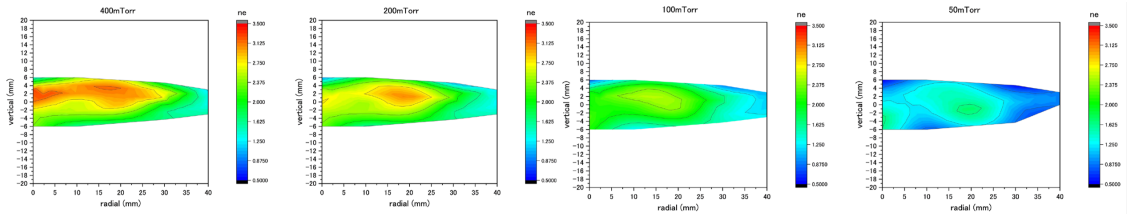

Fig.3 2D-n_e profiles with different gas pressure in the 450 MHz CCP.

As the results of the LTS measurements, it was found that n_e had a single-center-peak profile in the electrode's radial direction (80 mm diameter), while in the electrode axial direction (20 mm gap), higher n_e was observed at the position near the power electrode. At the low pressure (50 mTorr), the spatial gradient of n_e tends to be weaker, i.e., there is a possibility that the uniformity of 2D-ne profiles changes by changing the gas pressure.