# §19. Development of Compact Divertor Plasma Simulator for Hot Laboratory

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We have newly developed a compact divertor plasma simulator(CDPS), which is able to be operated in a radiation control area. The CDPS, having smaller space requirement and lower electric power consumption than conventional ones, is able to generate a steady state deuterium plasma. The sample stage equipped with an air-cooling system makes sample temperature almost constant during plasma exposure. The sample temperature during plasma exposure is controlled within uncertainty of 5K by changing the airflow rate. Further the plasma-irradiated sample can be transported to the infrared heater for thermal desorption spectroscopy (TDS) analysis without air exposure.

Fig. 1 shows the schematic of the CDPS equipped with two magnet coils. A dc plasma source is composed of a zigzag-shaped $LaB_6$ cathode and a water-cooled hollow copper anode. In the plasma source, high density steady-state plasma can be generated by the Phillips Ionization Gauge (PIG) discharge.

Fig. 2 shows the dependence of electron density on the discharge power. The CPDS is able to produce high density plasma in steady state to be $4.5 \times 10^{19} m^{-3}$ for helium and $1.5 \times 10^{19} m^{-3}$ for deuterium at the discharge power of 3.5 kW. The electron temperature is almost constant not depending on the discharge power. The plasma diameter of the plasma column is about 15 mm.

The CPDS has a sophisticated sample carrier system, which makes it possible to transport the plasma-irradiated sample on the sample stage to the infrared heater for TDS analysis without air exposure. It is able to guarantee more precise analysis of TDS. Fig. 3 illustrates the processes to transport the plasma-irradiated sample in vacuum. During plasma exposure, the sample is mounted on the sample stage by being hocked by the three molybdenum hocking pawls . After plasma exposure, the sample is removed by releasing the pawls . The dropped sample is received by a tray made of tantalum, which is mounted in the head of the sample carrier system. Finally, the sample is moved to the infrared heater of the TDS device by a motor drive. These processes are operated in vacuum. Therefore, the sample can be analyzed with TDS without air exposure following by plasma exposure, and the interval between the plasma exposure and TDS analysis can be minimized.

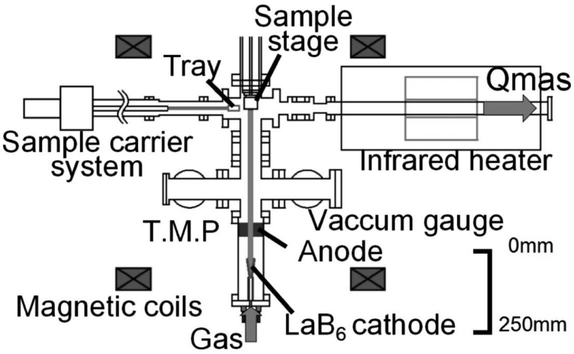


Fig. 1: A Schematic of the compact divertor plasma simulator (CPDS).

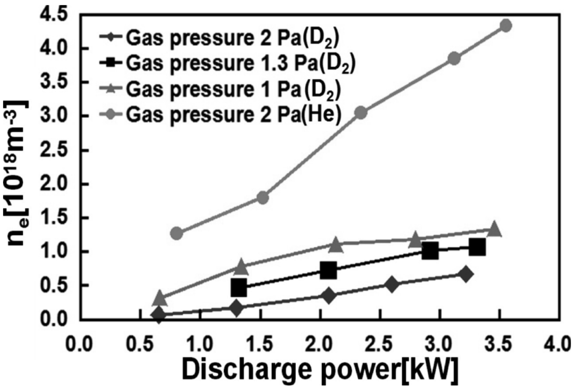


Fig. 2: Electron density as a function of the discharge power in helium and deuterium plasmas.

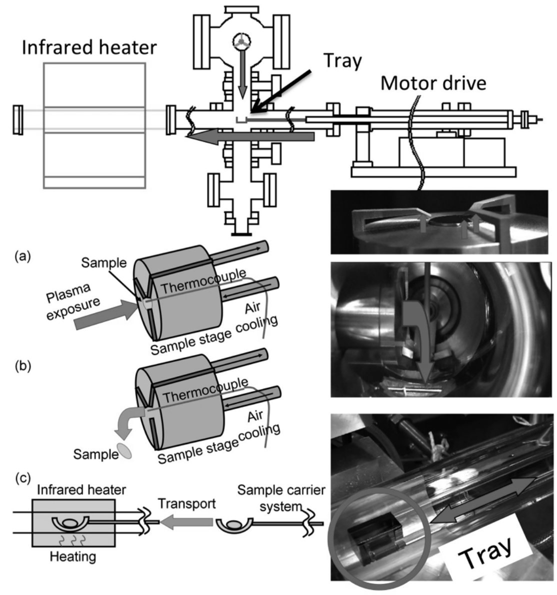


Fig. 3: Sample carrying system from irradiation-chamber to TDS device in the CPDS.