§18. Study on Gas Desorption and Absorption of Plasma Facing Wall for LHD Experiment

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Control for recycling of discharge gas such as hydrogen and helium is an important issue to improve the energy confinement of LHD plasma. The recycling largely depends on the retained amount of discharge gas at the wall. Then, the retention properties of discharge gas have to be clarified. For this purpose, glow discharge apparatus was constructed, and the retention of hydrogen and helium was investigated for stainless steel wall. In addition, the effect of glow discharge cleaning on the impurity of the wall surface has to be investigated. Then, the desorption of such the impurity due to the hydrogen or helium glow discharge was examined.

In order to obtain the retained amount of hydrogen or helium in the liner made by stainless steel, hydrogen or helium discharge was repeated. During the discharge, the retained amount of hydrogen or helium was measured by residual gas analysis, RGA. Time period of each hydrogen or helium discharge was 2 hr. Figure 1 shows the retained amounts of hydrogen and helium versus the discharge number. The retained amount of hydrogen was two or three orders of magnitude larger than that of helium. The retained amount of hydrogen or helium was approximately 10% reduced by helium or hydrogen discharge, respectively. These data are useful to understand the degree of recycling and the effect of glow discharge cleaning.

The desorption of impurities such as CO, CH_4, H_2O and CO_2 was also measured by repeating the hydrogen or helium discharge. Figure 2 shows the desorption amounts of impurities versus discharge number. The impurity desorption amount became very small after the several discharges. This result suggests that the top surface of the wall is cleaned by the discharge of several hours.

In order to clarify the effect of hydrogen and helium discharge on the impurity desorption, the material probes were installed and exposed to only hydrogen or helium discharge. Figure 3 shows the retained amount of impurity measured by thermal desorption spectroscopy, TDS, after the discharge. The retained amount of impurity was reduced by both the hydrogen and helium discharges. The reduction amount of impurity was comparable in both cases.

The present experiment was performed for the stainless steel wall with a temperature of RT. The next experiment will be conducted for the wall with an elevated temperature.

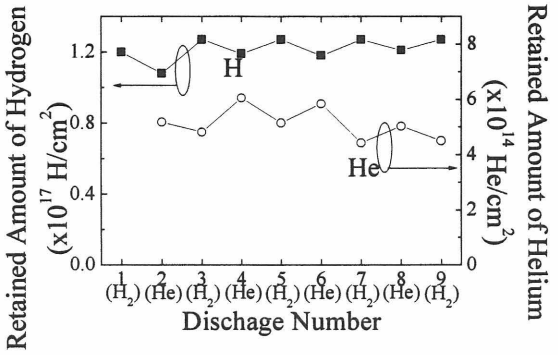

Fig.1 Retained amounts of hydrogen and helium versus discharge number.

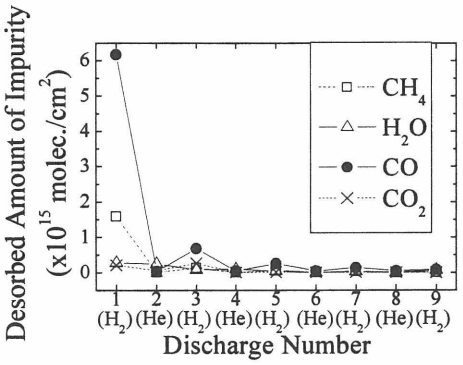

Fig.2 Desorbed amount of impurity versus discharge number.

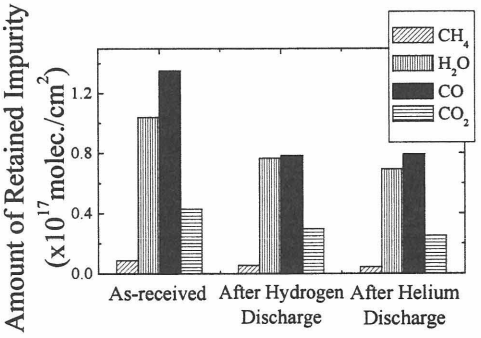

Fig.3 Retained amount of impurity after hydrogen and helium discharge.