§21. Characteristics of Ti Gettering Film with Oxygen and Hydrogen

Tsuzuki, K., Masuzaki, S.,Inoue, N., Sagara, A., and Noda, N.

Characteristics of Ti gettering film have been investigated with SUT (SUrface modification Teststand) to obtain basic data for application to LHD.

The titanium film is deposited on an inner surface of a liner by using Ti-ball™. After the deposition, the film are exposed to neutral gas of O_2 or H_2. After the saturation of the gas absorption, a glow discharge is carried out between an anode and the liner. Ions are accelerated to a few hundreds eV, and injected to the film. In addition, the active species are generated in the plasma, and affects the absorption behavior. This procedure allows us to distinguish the thermal gas absorptoin and the active particles one.

Figure 1 shows time evolution of the pressure during the O_2 gas exposure with flesh Ti film just after the deposition. The oxygen gas was introduced at the flow rate of 1.2 ccm. At first, the pressure did not increase because the Ti film strongly absorb O_2 gas. The pressure gradually increased after the 7 minutes and reach saturation value at 20 minutes.

After the saturation of the gas exposure, the mixture gas of 90% He + 10% O_2 was introduced through the mass flow controller and the total pressure was kept at 2.6 Pa. The pressure behavior during the discharge is indicated in Fig. 2. The pressure rapidly decreased when the discharge was ignited. It means that the Ti film absorbed the energetic ions and/or active O atoms even when the gas absorption had been saturated.

Similar experiment was carried out for H_2. In the case of H_2, the film was saturated with hydrogen by gas exposure, and thus, hydrogen atoms were not absorbed during the following H_2 discharge. The behavior agree well with the previous reports.

To investigate effect of H atoms on oxygen gettering ability, the oxygen absorption behavior was investigated after the saturation of H absorption. The absorption with gas exposure slightly decreased. The absorption with glow discharge was almost identical with that of H free film.

These resluts show favorable characteristics for application. The Ti film absorb O impurity during the main discharge even when the film are saturated by hydrogen and/or the thermal gas.

Another concern about the Ti gettering is the dependence of absorption capability on the film thickness. The film have to be thick enough to absorb O impurity effectively. However, the film might peel off if the film is too thick.

The dependenes were measured with similar precedure. The results are shown in Fig. 3. The close circles show absorbed amount during the glow discharge and the open circles show tha durring gas exposure. For the absroption with gas exposure, the absorbed amount increased almost linearly with the film thickness. The absorption with glow discharge also increased with the thickness but it almost saturate around the thickness of 50 nm.

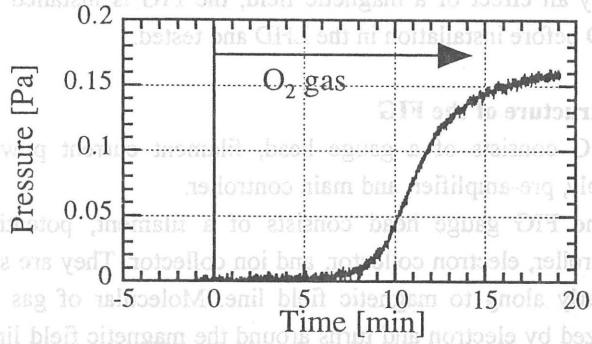

Fig. 1 Pressure behavior during O_2 gas exposure.

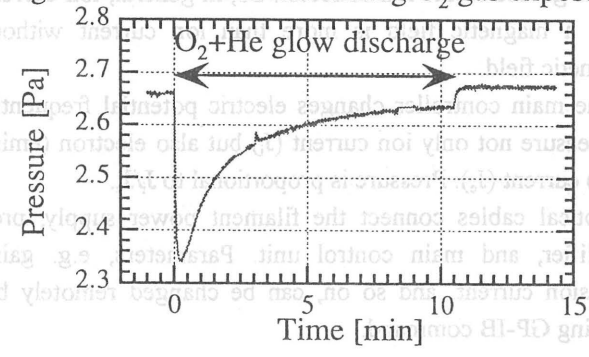

Fig.2 Time evolution of total pressure during glow discharge in 90% He+10% O_2

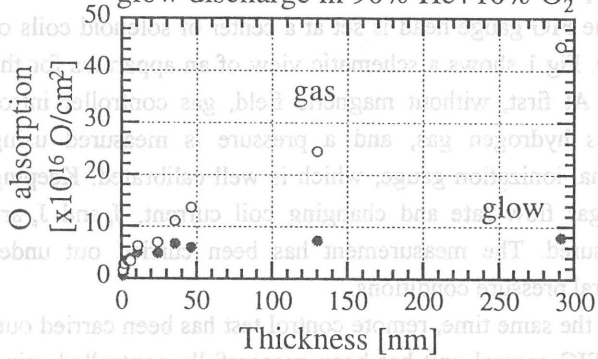

Fig. 3 Absorbed number of O atoms during gas exposure (open circles) and glow discharge (close circles).