§51. Hydrogen Retention Properties of Boron Film

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We prepared boron film on the graphite liner using DC glow discharge, and evaluated hydrogen retention properties and reduction of hydrogen retention due to helium glow discharge. The hydrogen retention properties of boron film were compared with the case of graphite.

Surface Modification Teststand(SUT) was used for this study. Liner was made of graphite(IG-110U). The DC glow discharge of B_2H_6(10%) + He(90%) mixture gas was applied for the boronization. The thickness of the boron film was about 200nm. Before the irradiation of hydrogen plasma, the hydrogen of the boron film was desorbed by the heating with temperature of 500 ℃. Then, hydrogen glow discharge was conducted to implant the hydrogen. The hydrogen pressure, plasma potential and plasma current were 2.7 Pa, 300-400V and 0.2A, respectively. During the discharge, the reduction of hydrogen partial pressure was monitored by a residual gas analysis(RGA). Fig. 1 shows the change of hydrogen partial pressure. The reduction of the pressure corresponds to the retained amount of hydrogen. The amount of hydrogen retention was $1x10^{17}$ H/cm^2. In the case of graphite without boron film, the amount of hydrogen retention was (7-8)$x10^{16}$ H/cm^2. The retained hydrogen amount of the boron film was comparable with that of graphite.

It is known that the helium ion irradiation can reduce the level of hydrogen retention. Then, the boron film after the irradiation of hydrogen plasma, was irradiated by the helium glow discharge. Fig. 2 shows the spectra of thermal desorption for cases after hydrogen plasma irradiation and helium plasma irradiation. The difference between two curves corresponds to the desorbed hydrogen amount due to helium plasma. This value was (1-2)$x10^{16}$ H/cm^2. In this experiment, it is seen that the helium discharge cleaning can reduce several ten percents the level of hydrogen retention.

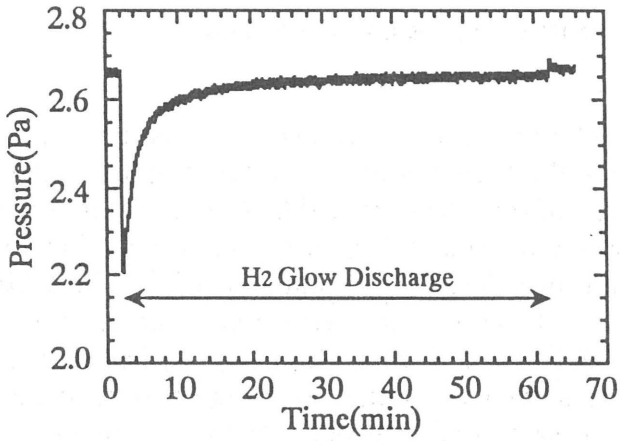

Fig. 1 Variation of hydrogen pressure during hydrogen glow discharge.

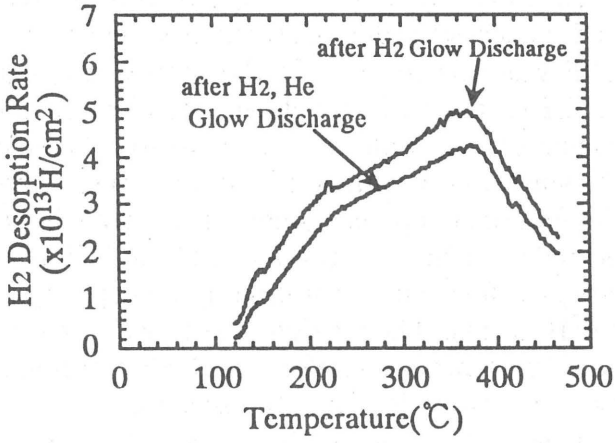

Fig. 2 H_2 desorption spectra by TDS after hydrogen glow discharge, and after helium glow discharge.