High Density Plasma Productions by Hydrogen Storage Electrode in the Tohoku University Heliac

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In the Tohoku University Heliac (TU- Heliac), the influence of a radial electric field on improved modes has been investigated by an electrode biasing. In both positive and negative biasing experiments by the stainless steel (SUS) electrode (cold-electron or ion collection), the improvement of plasma confinement was clearly observed. [1] Furthermore, by negative biasing with a hot cathode (electron injection), the radial electric fields can be actively controlled as a consequence of the control of the electrode current I_E. [2-4] By using the electrode made of a hydrogen storage metal, for example Titanium (Ti) or Vanadium (V), the following possibility can be expected: (1) ions accelerated from the positive biased electrode allow the simulation for the orbit loss of high-energy particles, (2) the electrons/neutral-particles injected from the negative biased electrode provide the production of the high-density plasma, if hydrogen are successfully stored in the electrode. In this present work, several methods were tried as the treatment for hydrogen storage.

In the case of the Ti electrode biased *positively* after the treatment, the improvement of plasma confinement was observed in He plasma, which were same as the experimental results of the SUS electrode. However, in the electron density profiles inside the electrode position there was difference between the biased plasma by the Ti electrode and that by the SUS electrode. In some of Ar discharges biased *negatively* with the Ti electrode after the treatment, the electron density and the line intensity of H_α increased about 10 times of those before biasing. This phenomenon has not been observed in the Ar plasma biased by the SUS electrode. This result suggested that the Ti electrode injected electrons/neutral-hydrogen into the plasma. This high-density plasma productions were observed only 1 ~ 3 times in the one treatment for hydrogen storage.

By using a Vanadium (V) electrode, productions of the high-density plasma, which was same as that in the Ti electrode experiments, were observed sequentially. In biasing experiments by the V electrode, the high-density plasma was observed in not only Ar plasmas but also He plasmas. The treatment condition for the V electrode was same as that for the Ti electrode. These results show that the V electrode was more useful than the Ti electrode for productions of the high-density plasma. The number of the high-density plasma productions increases so much that the detail study of this new type of discharge becomes possible. The measurement of the density and potential profiles will be carried out, and the formation of the density transport barrier will be investigated.

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