Discharge cleaning on KSTAR 1st plasma events

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1. Introduction

A discharge cleaning of a vacuum vessel was conducted with a GDC (Glow discharge cleaning) and a ICRF-DC(ICRF assisted discharge cleaning) for the KSTAR first plasma event period. The base pressure of the vessel was kept below 10-7 mbar via a cool down of the cryo-vessel, a 100C baking, and a GDC. (Partial pressure of hydrogen and nitrogen is below 10-8 mbar). The diagnostics for a discharge cleaning is a differential pumped RGA attached to a pumping duct and a cold cathode and a hot cathode gauge attached to the vessel and the pumping duct respectively. To analyze the discharge characteristics, a microwave interferometer, Bremsstahlung, H-alphas and a TV camera were used. Two straps among the four straps of the ICRF antenna are used for the ICRF-DC and ICRF heating experiments. The phase difference between the adjacent straps was 0 degree and the operating frequency was 30-33MHz.

2. GDC and ICRF-DC

GDC was performed over-night after a daily tokamak shot and early morning before a tokamak shot. Pure hydrogen discharge was used for the initial 1 hour following by a He discharge for removing the hydrogen attached to the vessel during a H discharge. The partial pressures of hydrogen, water, nitrogen and carbon compounds were increased during He-GDC as shown in Fig.1. ICRF assisted DC was used between the tokamak shots and it lasted for around 10 min. The injected RF power was limited to 30 kW by the high voltage on the transmission line and antenna from a low antenna loading resistance and the pulse duration was restricted by no water cooling to the antenna. The operational pressure region was from 10-3 to 10-4 mbar for the He and H discharges. The B_{TF} was from 0.5 to 1.4 T. The antenna loading resistance was slightly increased and plasma density was decreased as the B_{TF} is increased. Depending on the B_{TF} and RF frequency, a selective heating between an ion and an electron could be implemented. Whereas the plasma density was decreased at the flap top region for a successive shot when we applied ICRF-DC, there is no changes in the plasma density without the ICRF-DC. Only H2 partial pressure was changed for ICRF-DC and the H2 removal rate was about 3,6×10-3 Pa-m3/h. This is less effective than other machine results. More systematic study on a discharge cleaning with a more refined RGA system is necessary for the next campaign.

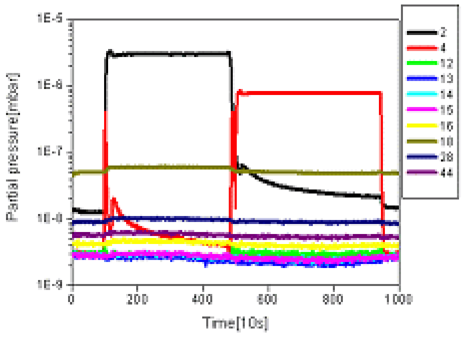

Fig.1. Partial pressure change for GDC
(First: H-discharge, Second:He-discharge)

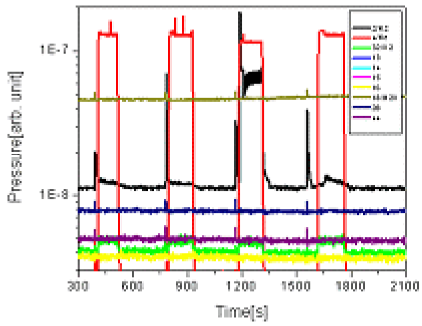

Fig.2. Partial pressure change for ICRF-DC(He ICRF-DC between the tokamak shots)