§6. Global Particle Balance Analysis in LHD

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Fuel absorption/desorption in the wall is important to identify for the particle control in fusion devices. "The wall retention analysis" is generally evaluated by two complementary methods: global gas balance and postmortem analysis using a material probe. In this study, we focus on the global gas balance analysis of plasmas by ICRH and ECH in long-pulses in LHD.

Analysis of global helium particle balance is conducted in ICRH and ECH discharge with only turbo pumps in the 18th experimental campaign experiments. The aim of the use of only turbo pumps not cryosorption pumps is to fix the pumping speed for the exhaust condition. The electron density is kept constant with ~1 $\times 10^{19}$ m^{-3} and averaged heating power is 1.6 MW. Figure 1 shows the result of global particle balance analysis. During the discharge for 17 min., the high wall retention is observed. Most of the puffed particles are absorbed in the wall. Here, the neutral helium in the vacuum vessel and the plasma particles are negligibly small. The exhausted amount is also small because only turbo pumps with the moderate pumping speed are utilized. In the 17th experimental campaign, at around 300 s, the wall retention was saturated. However, it takes 1,000 s to be wall saturation. The reason of the difference remains unclear. Further analysis is needed.

The difference of global particle balance between helium and hydrogen has been investigated in ECH only plasma. The twice of hydrogen gaspuff amount is needed for maintaining the same plasma density as shown in Fig. 2. At any case, most of the fuel amount is retained in the wall. It is suggested that the wall retention rate of hydrogen is twice as large as that of helium.

As a next step, the comparison between the global particle balance and the postmortem analysis should be conducted for the understanding of the mechanism of the wall retention.

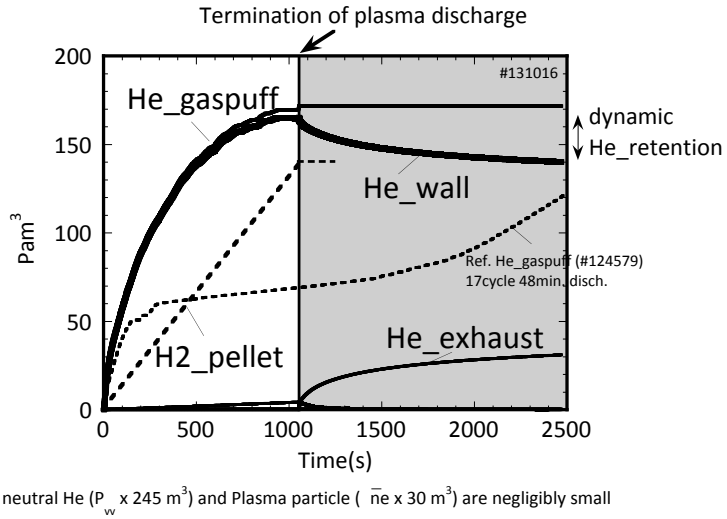

Fig. 1. Global particle balance analysis at 17 min. ICH+ECH discharge.

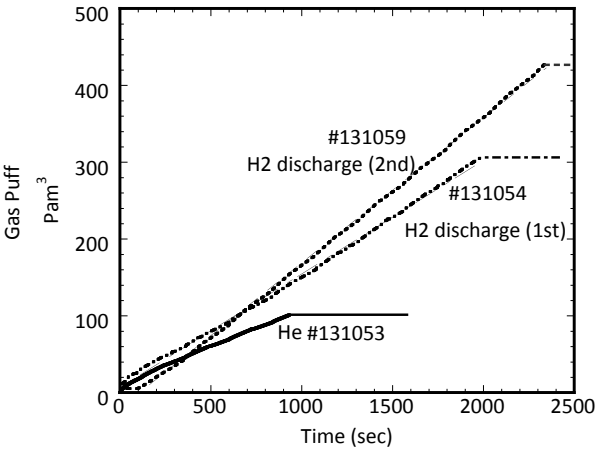

Fig. 2. Comparison of gaspuff fueling between hydrogen and helium plasmas in ECH heating.