

クエストにおける多点透過束計測プローブを用いた水素吸蔵束のポロイダル・径方向分布の直接計測とガスバランスの動特性について Direct measurement of poloidal and radial distributions of the retention flux with permeation probes and study of dynamics of gas balance on QUEST

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In order to understand particle balance in the plasma device direct measurements of the retention (Γ_{ret}) and release (Γ_{rel}) fluxes on the various plasma facing components (PFC) are required. The gas balance equation and wall retention rate q_{wall} are given as follows,

$$V \frac{dn}{dt} = -Sn + q_{gas} - q_{wall} - \dot{N}_{plasma},$$

$$q_{wall} = \sum_i A^i (\Gamma_{ret} - \Gamma_{rel})^i.$$

Because of the different plasma wall interaction between the plasma and PFCs q_{wall} must be evaluated by summing all contributions from PFCs. In QUEST permeation probes (PDP4-7) on the top, bottom and side walls are installed to measure Γ_{ret} [1]. Both proton and H atom fluxes can be also detected with the movable probe (PDP8) in the shadow of PFCs, as shown in Fig.1

The QUEST chamber (black) is made of SS and PFCs are tungsten (0.1mm) coated SS. The temperatures of the chamber and “hot wall” (grey) are 100 °C and 200°C, respectively.

A ECR slab plasma, whose main interaction region is localized on top and bottom plates, is examined. Figure 2 shows the radial distribution of Γ_{pdp} (circles) as a function of the distance between the PDP8 and the resonance location. Data points of other PDP indicate the reproducibility of two series of discharges (a 8.2GHz and b 2.45GHz). In case (a) 735 mm corresponds to the position of hot wall. The gas injection rate q_{gas} is $4.3\text{-}6.7 \times 10^{18}$ H/s (8.2GHz) and 8.6×10^{18} H/s (2.45GHz), respectively. It is found that the neutral H atoms play an essential role for the wall retention.

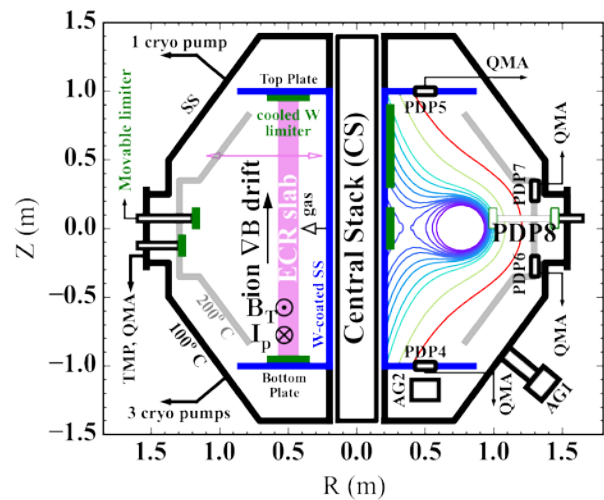


Fig.1 Experimental setup

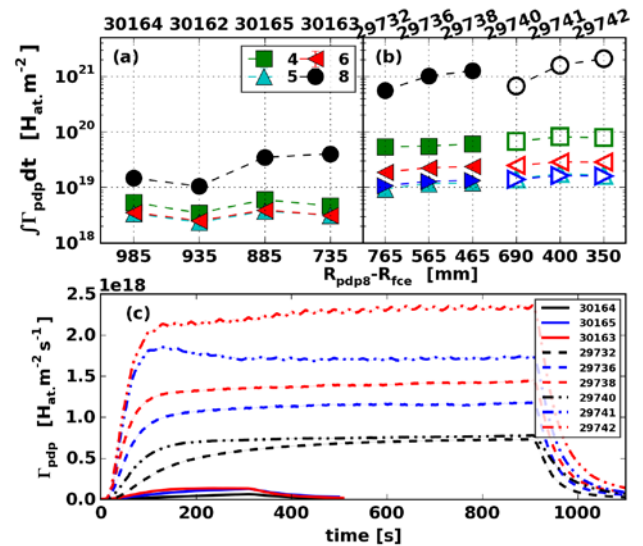


Fig.2 R-distribution of the permeation fluence (a)-(b). The wave form of Γ_{pdp} (c).

References

- [1] A. Kuzmin, et al., submitted to NF
- [2] A. Kuzmin, et al., ISI 2015 conference