

Retention and transmission of deuterium in tungsten on D-He mixture plasma

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Effects of deuterium (D) retention and transmission properties in the tungsten (W) material on D-He mixture plasma have been investigated on a linear plasma device TPD-Sheet IV. Used as sample is ITER grade tungsten. Titanium (Ti) target was placed on the back side of W target to investigate the retention and transmission properties. The amount of D retention in W increases with increasing the pure D plasma flux. On the other hand, the amount of D retention in W is nearly constant with increasing the D-He plasma flux. At the same time, the amount of the D retention in Ti increases with increasing the D-He plasma flux. It was found that the incident flux of D-He mixture plasma effects on the transmission of D in W.

1. Introduction

Tungsten (W) was chosen as a plasma-facing material in the ITER divertor region because of its high melting temperature, high thermal conductivity and low sputtering erosion yield. In the divertor, it is inflowing that hydrogen isotopes as fuel particles of unreacted besides helium ash. In the inflow to come a lot of fuel particles, there is also a fuel particles that result in accumulated and occluded in divertor material [1, 2]. So it is important to understand the behavior of hydrogen isotopes in tungsten of the divertor wall material.

In this study, we have performed the irradiation experiments using deuterium and helium mixed plasma in order to investigate the effect of deuterium retention and transmission properties in the tungsten material by helium.

2. Experimental Setup

The samples were exposed to plasma in the linear divertor plasma simulator TPD-Sheet IV at the Tokai University. Either D plasmas, or He mixed D (D + He) plasmas was used. Samples were positioned at the end of the plasma column. Used as sample is ITER grade tungsten in the form of square plate with the thickness 1mm, was annealed to adjust the crystal grain boundaries. The deuterium transmission property of the tungsten material was investigated by the titanium plate which is mounted behind the tungsten as deuterium storage materials. The ion density in the D-He mixture plasma was measured by the omegatron mass analyzer.

3. Experimental Results

The retention property of deuterium with regards to the ion density ratio of helium is investigated. When the gas flow rate of the helium is increased, amount of

deuterium in tungsten did not change and the amount of deuterium in titanium increased.

The retention property of deuterium with regards to incident flux is shown in Fig. 1. The amount of D retention in W increases with increasing the pure D plasma flux. On the other hand, the amount of D retention in W is nearly constant with increasing the D-He plasma flux. At the same time, the amount of the D retention in titanium increases with increasing the D-He plasma flux. It was found that the incident flux of D-He mixture plasma effects on the transmission of deuterium in tungsten.

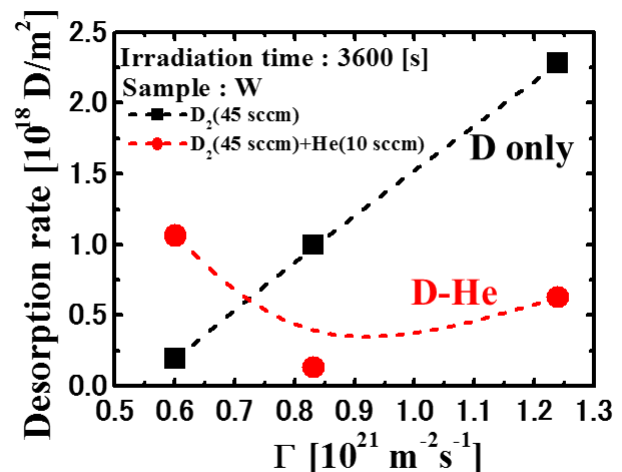


Fig. 1. Retention property of D₂ regarding incident flux

References

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