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## タングステン－10%レニウム合金における重水素透過に関する研究

## Deuterium gas driven permeation behavior for W-10%Re alloy

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### 1. Introduction

For safety operation for fusion reactor, evaluation of hydrogen isotope permeation behavior in tungsten (W) is required. In the fusion environment, W will be exposed by energetic hydrogen isotopes and neutrons, leading to the formation of W-Re alloy by nuclear reaction. As the neutron fluence is increased, Re ceoncentration will be increased up to several % in ITER condition. Therefore, the contribution of Re on hydrogen permeation is quite important. In this study, W-10%Re has adopted and their deuterium (D) permeation behavior was evaluated.

### 2. Experiment

Polycrystalline W-10%Re samples (6mm$^{\varphi}$,0.5mm$^{t}$) purchased from A.L.M.T. Co. Ltd were used. After the pretreatment by annealing, the sample was sandwiched between gold coated metal O-ring that sealed in sample holder. The sample holder introduced in gas driven permeation (GDP) device and introduce $D_2$ gas into upstream side regulated by variable leak valve (V.L.V). D permeation rate was measured as a function of gas pressure at 20 – 80 kPa and temperature between 883 and 983 K. The vacuum at the downstream side was maintained at ~ $10^{-7}$ Pa by a turbomolecular pump (TMP). D permeation was quantified by a quadrupole mass spectrometer (QMS), which was calubirated by a standard $D_2$ leak bottles. Permeability was calculated by lag-time method.

### 3. Results and discussion

Fig. 1 shows the temperature dependence of D permeability for W-10%Re and W. The permeability of D for W-10%Re was larger than that for W at higher temperature above 933 K. It was reported that Re was precipitated at the defects in W-Re alloy, which would enhance the D permeability at higher temperature.

Pressure dependence of D permeability for W-10%Re was also measured. Based on the experimental results, the slope of permeability on the $D_2$ pressure at upstream side for W-10%Re was estimated to be 0.79, which was higher than that for W, namely 0.5, indicating that D permeation behavior for W-10%Re was controlled by surface recombination.[3]. In this presentation, more detail experimental results related to D transport in W-10%Re will be discussed.

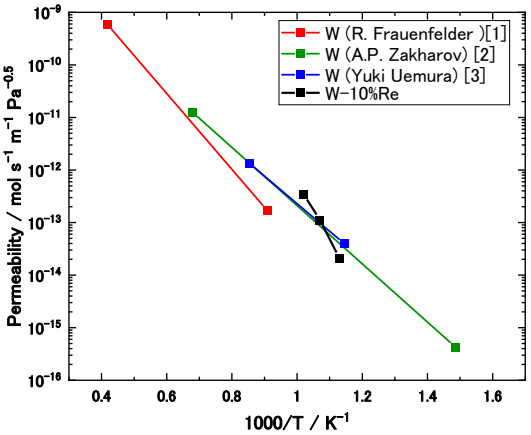


Fig. 1 Temperature dependence of D permeability for W-10%Re and W.

### References

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[3] Yuki Uemura, et al., J. Nucl. Mater. 490 (2017) 242.