§12. Moving-Surface Plasma-Facing Components for Particle Control in Steady-State Magnetic Fusion Devices

Hirooka, Y. (NIFS),
Fukushima, H., Ohno, N., Takamura, S. (Nagoya University)

In the fusion community much attention has recently been directed to particle control for both fuel and impurities in the existing magnetic fusion experiments, as it is recognized that the core plasma performance can directly be affected by the edge conditions. However, it is still true that there is no clear strategy to cope with the needs for steady-state reactor operation. That is that, due to the saturation nature, wall conditioning such as boronization, widely used for particle control, will not probably be applicable for steady-state devices. It follows immediately from this that steady-state particle control requires a start from enabling concept development.

As a possible solution to this situation, the concept of moving-surface plasma-facing components (MS-PFCs) was proposed and was found to be rather promising in our previous studies [1, 2]. In this concept, the moving-surface will continuously be coated off-line with low-Z materials such as lithium, for gettering hydrogenic species as well as imThe present work is intended to conduct proof-of-principle (POP) experiments on the MS-PFC concept. More specifically, it is our expectation to observe in these POP experiments that hydrogen recycling less than 100% is established at steady-state, and improved plasma cleanliness is achieved due to unsaturable impurity control.

A prototypical MS-PFC unit that employs a actively-cooled copper rotating drum has been constructed, as shown in Fig. 1. This rotating drum is made of copper can be exposed to vaporized titanium, a surrogate getter material for POP experiments. This MS-PFC test unit has been connected to the steady-state plasma device, NAGDIS-1 [3] for plasma exposure.

As shown in Fig. 2, spectroscopic data on H_α light taken in front of the rotating target indicate that about 6% reduced hydrogen recycling has been achieved at steady state. In support of these data, zero-dimensional particle balance modeling predicts a 7% reduction in hydrogen recycling. Lithium gettering expepriments are currently under way.

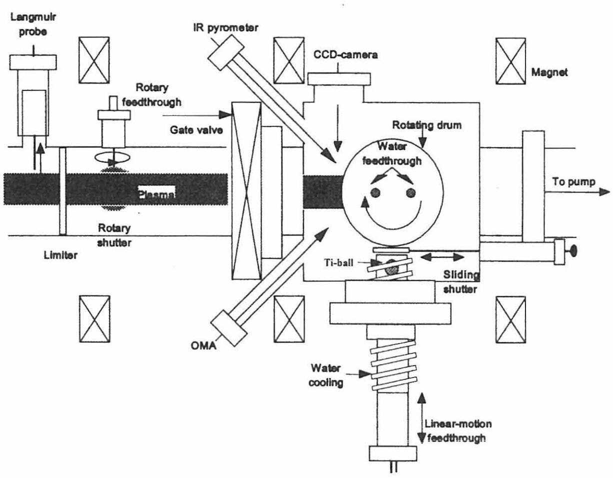

Fig. 1 A schematic diagram of the experimental setup.

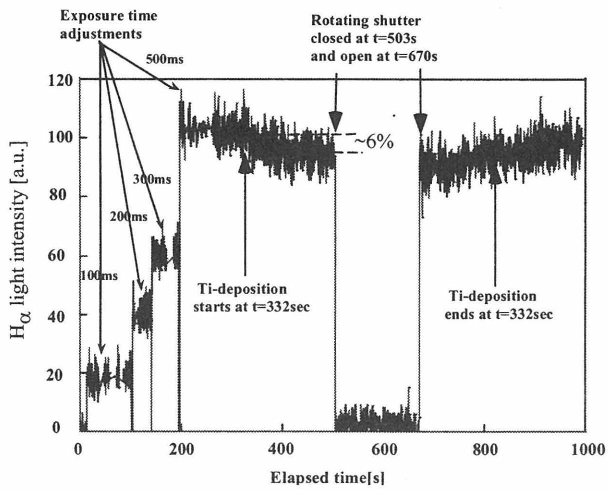

Fig. 2 Spectroscopic measurements on hydrogen recycling.

References

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[3] M. Kojima and S. Takamura, J. Nucl. Mater. **220-222**(1995)1107.