Particle Control by Lithium-Gettered Moving-Surface Plasma-Facing Components in Steady State Magnetic Fusion Devices

Y. Hirooka[1], H. Ohgaki[2], Y. Ohtsuka[2] and M. Nishikawa[2]

[1]*National Institute for Fusion Science, Oroshi, Toki, Gifu, Japan, Zip Code: 509-5292*
[2]*Osaka University, Yamadaoka, Suita, Osaka, Japan, Zip Code: 565-0871*

Ever since the discovery of TFTR's Supershot in late 80's, high performance confinement plasmas have often been found to favor low edge recycling conditions. Therefore, wall conditioning such as boronization has routinely been conducted in many confinement devices. Unfortunately, however, due to the surface saturation with implanted particles, the efficacy of boronization to maintain particle recycling at low levels has finite lifetime, necessitating re-conditioning. This clearly points to the need for enabling wall concept development to provide reduced recycling even at steady state for the future long-pulse or steady state fusion devices.

As a possible resolution to this steady state plasma-surface interactions issue, the concept of moving-surface plasma-facing component (MS-PFC) was proposed while ago [1]. Recently, laboratory-scale proof-of-principle (PoP) experiments have successfully been conducted, employing a continuously Ti-gettered rotating drum exposed to steady state hydrogen plasmas, and the results indicate that wall recycling reduced down to 95% can be maintained at steady state [2]. In our previous paper [3], these experiments were extended, using Li as the getter, and some of the preliminary but encouraging results, including steady state recycling of 90%, were reported.

In the present work, the particle control capability of the Li-gettered rotating drum has been extensively investigated with the particular emphasis on understanding the relationship between the deposition rate and steady state recycling level. Shown in Fig. 2 are the recycling data taken from a continuously Li-gettered rotating drum at the deposition rate of 13 /s. Notice that a 4% reduction is attained at steady state in hydrogen recycling, measured with H_α spectroscopy, over the Li-gettered rotating drum. To conduct particle balance analysis, similar to that performed for the Ti-gettered case [2], sticking coefficient measurements have also been conducted for Li. Results indicate that the sticking coefficients of hydrogen molecules and hydrogenic species in hydrogen plasmas are 7.5 x 10^{-4} and 0.31, respectively. Detailed analysis is under way.

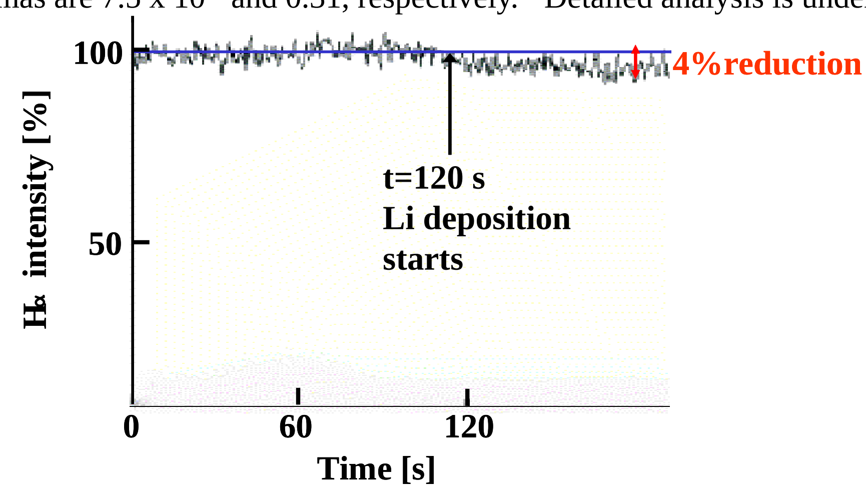

Fig. 1 Reduced recycling at steady state demonstrated by the Li-gettered rotating drum.

[1] Y. Hirooka et al., Proc. 17th SOFT, San Diego (1997), p. 906-910.
[2] Y. Hirooka et al., Fusion Eng. & Design, **65**(2003)413-421.
[3] Y. Hirooka et al., Fusion Sci. & Technol. **45**(2004)60-64.