§11. Particle Control by Low-Z Materials Coating

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There has been a growing interest in wall conditioning with lithium layer deposition since the first laboratory experiment[1] and lithium pellet injection on TFTR[2]. To date, the Li conditioning has been done in several devices; TdV, JIPP-TIIU[3], DIII-D and Heliotron-E. In most cases, the pronounced conditioning effects have been found on remarkable decreases in O and C impurities along with low H recycling. In addition, the laboratory studies [3] revealed various chemical activities of Li layer: (1)Gettering of residual gases such as H_2O, O_2, CO and CH_4, (2)Suppression of CO from graphite, (3)Enormous uptake of H up to a saturation level of the atomic ratio H/Li~1.

To make the lithium conditioning effects clear, a thin lithium layer is deposited on a graphite sheet wall and a hydrogen glow discharge is turned on to see a methane yield. Fig.1 shows the methane yield measured for the different values of the discharge current I_D and the wall Temperature T_W, comparing the data with and without the lithium deposition. The methane linearly increases with the current I_D, while the methane yield weakly increases with the wall temperature. When lithium layer is deposited, the methane yield is turned out to be reduced by ~25% compared with the case of bare graphite surfaces.

Thermal desorption of H_2 from the Li layer which had been exposed to hydrogen glow was measured. Fig.2 shows examples of TDS. The curve "A" shows a peak at T~200 °C and most of H contained in the Li layer are easily desorbed at relatively low temperatures. However, the curve "B" obtained in different conditions shows the H release not only at low temperatures but at high temperatures (700 °C).

Hydrogen molecules and lithium atoms released from a commercially available LiH powder were measured, which showed thermal decomposition reaction, $2LiH \rightarrow 2Li + H_2$, for T>400 °C. Thus, the second peak of the curve B at T~700 °C is interpreted as the thermal decomposition of LiH The first peak for T<200 °C has not been understood yet but it might be interpreted as a result of oxygen contamination effect.

More clear-cut experiments are needed to understand the lithium wall conditioning effects.

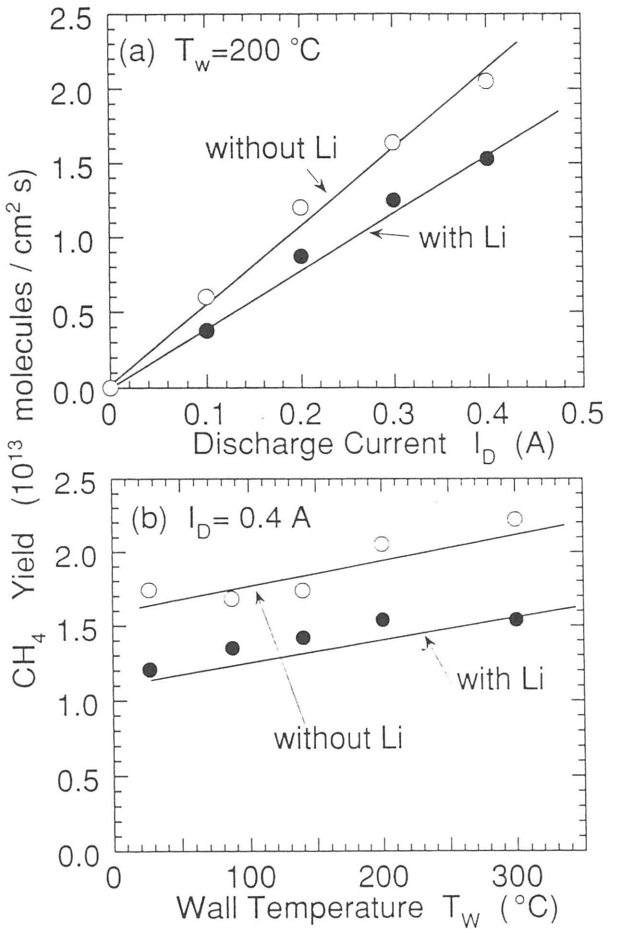

Fig. 1. Methane yield from graphite with/without Li deposition, for (a) constant wall temperature T_W=200°C and (b) constant current I_D=0.4 A.

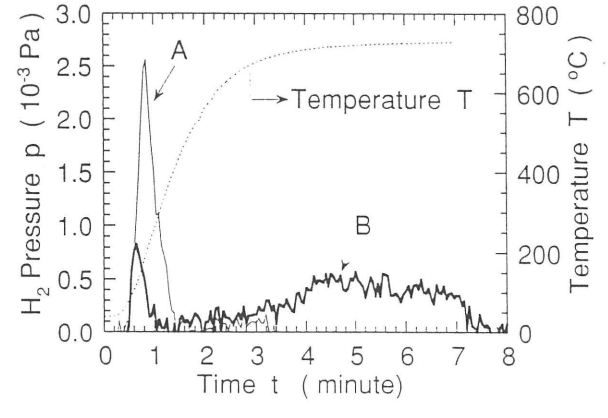

Fig. 2. Thermal desorption of H_2 from Li deposited wall. The solid lines A and B indicate hydrogen pressures and the dashed line the wall temperature.

References
1)Isozumi, T., Yoshida, S. Sugai, H., Kaku-Yugo Kenkyu 60(1988)304.
2)Snipes et al., J. Nucl. Mater. 196-198(1992)686.
3)Sugai, H., Toyoda, et al., J. Nucl. Mater. 220-222(1995)254-258.