
Zushi, H., Okamoto, K., Bhattacharyay, R. (RIAM Kyushu Univ.), Sato, M., Hirooka, Y.

In order to operate fusion reactor in steady state, it is inevitable to control the plasma wall interaction (PWII). Especially particle retention in the co-deposited multi layer is crucial problem. Although it is considered that the elementary processes are functions of the materials, thickness, surface temperature so on, the on-line quantitative assessment of the amount of the retained particle is difficult. Recent interests in the fusion community are how the tungsten plays a role in particle retention.

The purpose of this research program is to establish the database of the particle retention in sprayed W as a function of the surface temperature. This program is complementary to the bi-directional research program between NIFS and Kyushu University, namely active recycling control with a moving surface PFC (rotating limiter) coated by Lithium.

The example of plasma spray W on SUS is shown in the fig. 1 A diameter is 30 mm and thickness is mm.

![Fig. 1 Plasma spray W plate](image)

This sample is exposed in one hour to the RF plasma whose temperature is 2-5 eV and density is ~ $10^{16}$ m$^{-3}$.

![Fig. 2 SEM of the W surface (A) after exposure, (b) before exposure](image)

The SEM photographs are shown for before (right) and after (left) plasma exposure. In order to promote the out gassing from the W layer, the SUS plate is heated at ~ 800 K by sheath heater.

![Fig. 3 EDX before(right) and after (left) plasma exposure](image)

Comparison with the EDX spectrum is shown in Fig.3. Before exposure O is found, however it disappears after exposure.

During one hour plasma exposure, the surface temperature of the W reaches ~ 750 K. At such high temperature particles are not considered to be retained in the W layer. The retention is measured after the sample is cooled down to ~ 300 K. The sample is heated up to 830 K for 25 min. However, no clear rise in mass spectrometer signals for H$_2$ and H$_2$O is found.

In order to release retained H-particles He plasma and biased plate are used. Just after He plasma production sharp rises in both H$_2$ and H$_2$O are found, as shown in Fig4.

![Fig. 4 Desorption flux and surface temperature are shown as a function of TDS and He plasma irradiation.](image)

The results of bias voltage from 0 to 200 V are taken for the various W samples. Although the bias voltage is 0, the sheath accelerated He ions of 3 Te (< 15 eV) irradiate the W surface and retained H particles are released.

H-plasma irradiation and H retention from the plasma sprayed W layer have been studied at high surface temperature. Although it is not expected, the particle desorption flux of ~ $2 \times 10^{13}$/cm$^2$/s is found above ~ 1000 K.