§87. Study on the Direction of Deposition in QUEST Using Directional Material Probes

Masuzaki, S.

A simple method for deposition layer studies, directional material probe (DMP)[1], was applied to the study of deposition layer formation in QUEST. The study focused on the directionality of the deposition layer formation. The probe consists of a flat disk and a pin as depicted in Fig. 1. If deposits arrive with directionality, shadow of the pin is formed on the deposition layer on the disk. If there is no shadow on the deposition layer, it suggests that the deposition layer was formed isotropically.

The DMPs were installed on the plasma facing surfaces in the QUEST vacuum vessel during the experiment campaigns in 2010-2013, respectively. In the QUEST vacuum vessel, the first wall material is stainless steel (SUS316L), and the divertor plates are made of tungsten. The center stack is covered by the W coated stainless steel (SUS316L) plate. Here I report the results of the surface analysis of a DMP installed at the positions of 4 shown in Fig. 2 in 2013 SS experiment. The diameter of the disk and the shading pin of the DMP were 30 mm and 5 mm, respectively. The disk material was SUS316L. The DMPs were taken out from the vacuum vessel after the experiment campaign.

Glow Discharge Optical Emission Spectroscopy (GDOES) was applied to analysis of the deposit materials on the DMP, and the insertion in Fig. 3 shows the DMP after the GDOES analysis. The small circles on the DMP surface are the discharge spots (~2mm ϕ). Figure 3 shows the emission intensity of Fe, W, C and H. W deposition on the surface is clearly observed which is not clear by the visual observation. Figures 4 show the angular distributions of the GDOES peak intensities of W, C and H, respectively. The distribution of H is almost uniform, though those of W and C are non-uniform. The non-uniform distributions are considered to be attributed to that W and C deposited with directionalities. In the case of W, the direction of the W deposit looks from right hand-side to left hand-side. On the other hand, the direction of the C deposit looks from the both sides. The mechanism of the directionalities has not been understood yet.

1) Masuzaki, S.: Plasma Fusion Res. **8** (2013) 1202110.

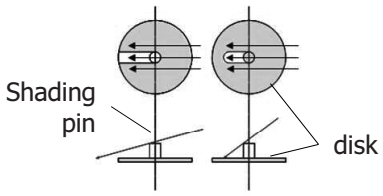

Fig. 1. Schematic views of the idea of the directional material probe. The hatched parts are deposition layer. Arrows show the incident angles and directions of deposits. Two figures are for different incident angles of deposits, respectively.

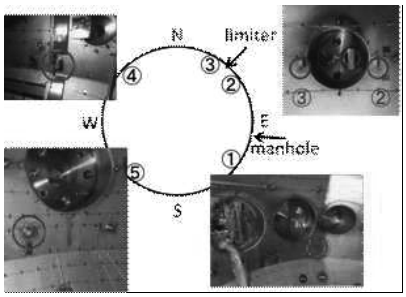

Fig. 2. Photos of the DMPs in the QUEST vacuum vessel and their positions in the vacuum vessel

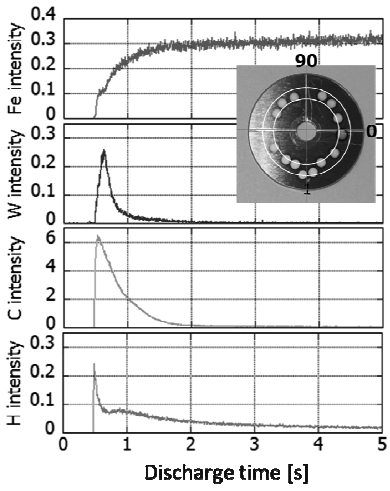

Fig. 3. Emission intensities of Al, C, Fe and W observed by the GDOES as a function of the discharge time which corresponds to the depth. (insertion) Photo of the DMP after the GDOES analysis. The definition of the angle is shown.

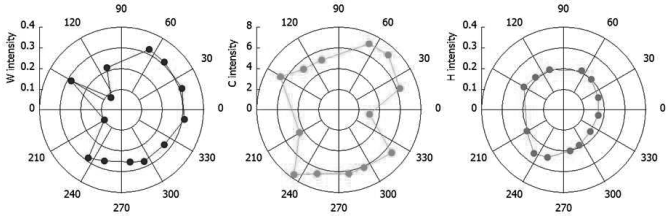

Fig. 4. Angular distributions of the GDOES peak intensity of W, C and H.