§85. 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. The positions of the DMPs are shown in Fig. 2. All the DMPs were installed on the first wall. The diameter of the disk and the shading pin of the DMP were 30 mm and 5 mm, respectively. The disk material was alumina in the 2012 AW experiment campaign. The DMPs were taken out from the vacuum vessel after the experiment campaign.

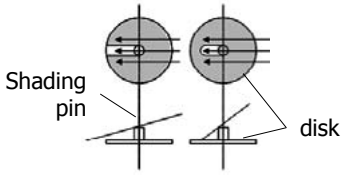

Fig. 1. Schematic views of the idea of the directional material probe. The hatched parts are deposition layer. Arrows show the incident angles and directions of deposits. Two figures are for different incident angles of deposits, respectively.

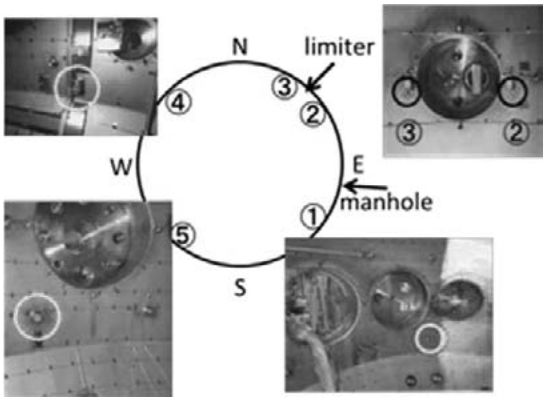

Fig. 2. Photos of the DMPs in the QUEST vacuum vessel and their positions in the vacuum vessel

Figure 3 is the photo of DMPs. The colors of the all DMPs were drastically changed after the experiment campaign by the deposition layer. The directionality of the deposition layer is not visually clear on the #2 and #3 DMPs. It suggests the deposit materials arrived isotropically. On the #1 and #3 DMPs, very feeble shadows were formed. The mechanisms of the directionality formation have yet to be revealed at this stage.

Glow Discharge Optical Emission Spectroscopy (GDOES) was applied to analysis of the deposit materials on the #3 DMP. Figure 4 shows the emission intensities of Al, C, Fe and W as a function of the glow discharge time which corresponds to the depth. Al is the main component of the disk material (alumina). W deposition was observed, and the depth profile is similar to that of Fe. C deposition was also observed, and the depth profile is different from those of W and Fe.

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

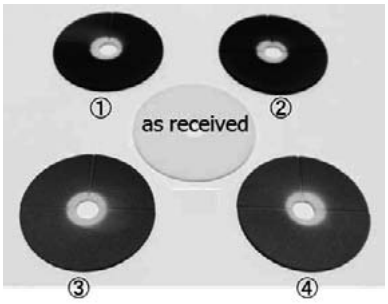

Fig. 3. Photos of the Alumina DMPs after the experiment campaign 2012AW.

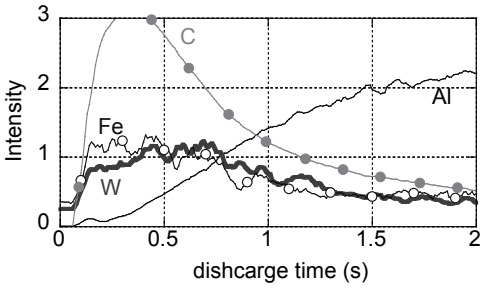

Fig. 4. Emission intensities of Al, C, Fe and W observed by the GDOES as a function of the discharge time which corresponds to the depth.