§51. Helical Divertor System

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A full toroidal, helical divertor system was completed and fully in use through the third campaign. In vessel part of the system consists of 40 units of cooling pipe made of stainless steel, graphite target tiles with copper heat sinks. One unit covers 180 degree in poloidal direction. The cooling water flows into the vacuum vessel through the bottom port-hales and goes out through the top. The tiles are mechanically attached to the heat sinks, which are fixed to and supported by the cooling tubes fixed to the vacuum vessel. Stainless steel bolts are used for the fixation between these elements. Carbon sheets are inserted into the contact surfaces in order to improve heat transfer. Arrangement of the plate element is shown in Fig. 1. In total, 1742 tiles were installed.

Figure 2 a) is around an out-board horizontal port-hole with a tangential port-hole. In this part, a branch which cross the tangential port-hole makes a detour along its edge. In order to receive the flux to this part, four tiles are set inside the tangential port-hole, as seen in the figure. Figure 2b) shows the divertor tiles of the inboard side without any port-hole. In the section with an inboard horizontal port-hole, the tiles and the cooling pipes are a bit expanded horizontally to keep a plasma view through this port-hole.

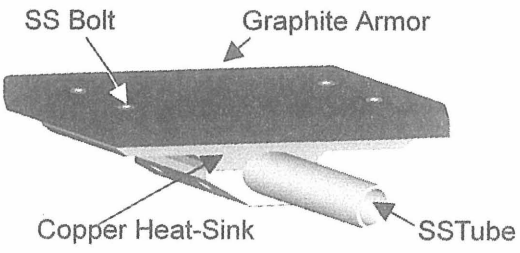

Fig.1 Divertor element

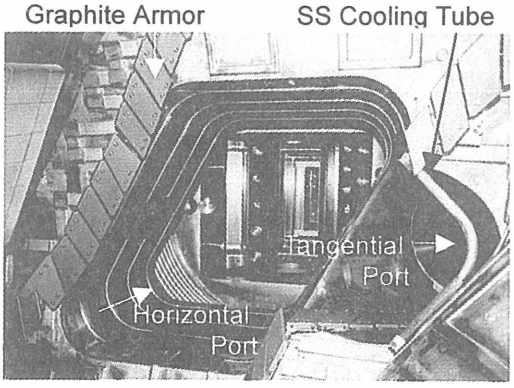

Fig. 2 a) An outboard unit where a tangential port-hole is located

It was clearly seen that radiations from iron impurities went down significantly in the third campaign compared with those in the second campaign, in which the divertor legs directly touched to the stainless steel wall[1]. Core radiation obtained by bolometer array decreased[2], too. This indicates that (1) plasma wall interactions are dominated at the striking positions of divertor and (2) the graphite tiles cover most of the divertor striking points successfully. High power, long pulse discharges have been safely operated with the helical divertor. After the third campaign, it was found that clear traces of deposition are sitting on the graphite tiles. Thus it has been verified that the helical divertor is effective to control plasma –wall interactions in Heliotron type configuration. Further improvement of the system is planned for alignment of the tiles and heat removable capability.

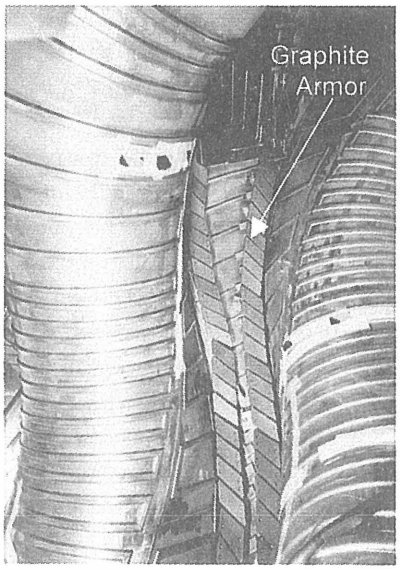

Fig. 2 b) An inboard unit where no Port-hole is located

Reference

1) contributed by K. Sato, described in N. Noda et al., Proc. ITC-10, to be published in J. Plasma Phys. Fusion Res.
2) B. J. Peterson et al., to be presented in 14th PSI Conference at Rosenheim, May 2000.