§58. R&D Teststand for Cooling System of First Wall and Plasma Vacuum Vessel

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The temperature of LHD plasma vacuum vessel is required to control lower than 347 K, to keep the temperature of 80 K shield which is located at the coil side of the vacuum vessel. The wall cooling system of plasma vacuum vessel is located at the narrow space (< 25 mm) between plasma and vessel on the small major radius side of the torus (radial build). Here, the cooling system with water cooling pipe and protect plate (first wall) is considered.

Figure 1 shows the plasma vacuum vessel (components between plasma and coil can). The water pass is formed by U-shape cross section bar of stainless steel (SS: 10 mm x 28 mm, 2 mm thick) which is welded to the vessel wall. The intervals of water passes are 80 mm on the small major radius side of the torus, and 200 - 250 mm on the other parts. First wall is made of 10 mm thick SS plate which one side is covered by 0.5 mm thick copper plate. Size of the plate depends on its location, the largest one is about 250 mm x 400 mm. The plates are mechanically fixed to the water pass by using saddle on the vessel wall and bolts.

To certify the efficiency of cooling component, R&D teststand for first wall cooling has been prepared (Fig.2). The size of the main chamber is ϕ 500 mm x 800 mm which has 8 ports for vacuum pump (TMP + RP), heating power supply, water supply and temperature measurement. The sample of the first wall (SS and Cu) is jointed on sample vacuum vessel with water cooling path.

The maximum total heat flax from LHD plasma is 3 MW in steady state operation (CW). Typically, a half of heat flux reaches the vessel wall and another half of heat flux reaches the divertor plate. This flux of the vessel is 1.5 MW (1.5 W/cm^2 on the vessel wall at the radial build). The heating power in the test chamber is supplied by IR heater or electron beam (1kV, 1A). Temperature is measured by T.C. (CA).

The test is in progress. Thermal conductance of saddle between first wall and vessel, effect of copper plate on stainless steel of first wall, and the temperature of vacuum vessel between cooling pipe will be investigated.

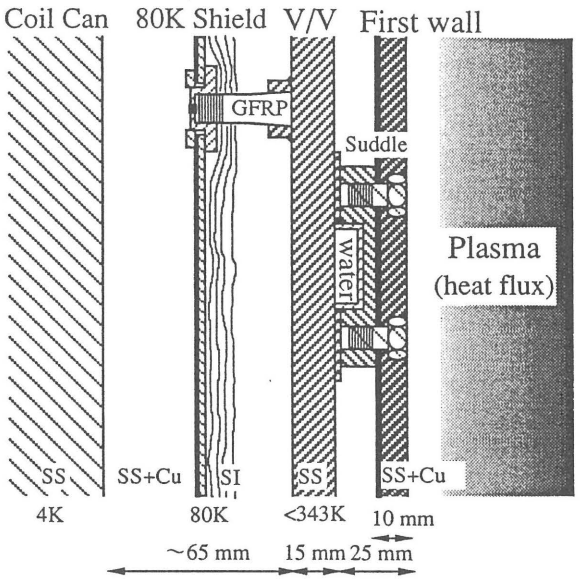

Fig.1 The first wall on plasma vacuum vessel with other components (radial build).

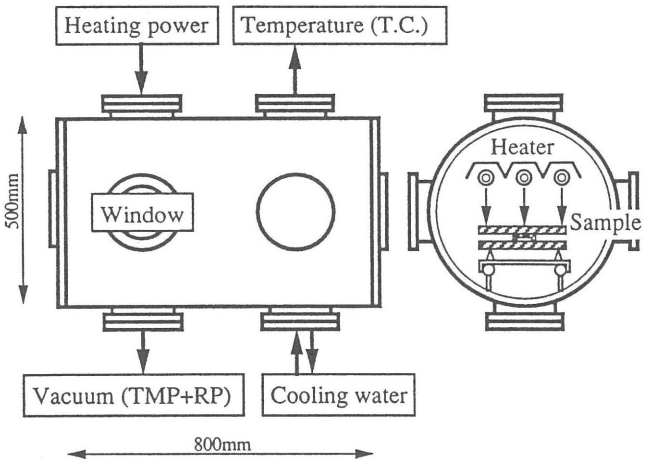

Fig.2 The R&D teststand for wall cooling component (vessel, cooling path and first wall).