§50. Overall Evaluation for Plasma Facing Material for LHD

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Confinement characteristics strongly depend on the plasma surface interactions. In particular, erosion and fuel hydrogen recycling have to be clarified. The high heat flux components also have to be developed for a heat removal of the divertor. For this purpose, the overall discussions for the LHD plasma facing materials have been conducted in three research meetings for Fy 1995. In the followings, the obtained remarks are summarized.

Local Island Divertor (LID) will be used in the early operation phase of LHD. LID has a high particle pumping efficiency and so that this divertor contributes to reduce the hydrogen recycling. Preliminary experiments in CHS showed the improvement of confinement time when the LID field was applied. The heat flux to this divertor head is high, 10 MW/m^2, and then the use of CFC or the modified CFC is adequate.

In order to avoid the serious erosion of the wall material, the temperature has to be suppressed below approximately 1000 °C. High heat flux experiments showed that the heat flux for the temperature to become 100 °C were 12, 10 and 8 MW/m^2 for brazed components made by CFC, SiC converted graphite and B_4C converted graphite, respectively. In addition to the brazed material, mechanically jointed components have been developed. In spite of the simple structure, the heat removal performance was quite good, e.g. stable for the heat flux of 5 MW/m^2.

Since the first wall temperature of LHD is limited below 100 °C, the oxygen impurity level has to be reduced by using the gettering scheme. Boronization has been regarded as one of promising method. The hydrogen concentration of the boron film made at 100 °C was about 20 %. Even if the boronization was conducted for low temperature wall, it was seen that the oxygen gettering ability was sufficiently enough for several ten shots,

The above conclusive remarks are useful both for the design of LHD wall and conditionings for the LHD wall. Further continuos researches and discussion are required.

References

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