# Effects of divertor plasma on impurity deposition on the LHD first wall

G. Kawamura, Y. Tomita, M. Kobayashi, M. Tokitani, S. Masuzaki, A. Kirschner[a]

*National Institute for Fusion Science, 322-6 Oroshi-cho, Toki 509-5292, Japan*
*[a]Institut für Plasmaphysik, Forschungszentrum Jülich GmbH, Germany*

kawamura.gakushi@nifs.ac.jp

Impurity transport and deposition of impurities on surfaces in plasma confinement devices are essential issues in fusion plasma devices. In the Large Helical Device (LHD), simulation study for understanding of impurity dynamics and interaction between plasma and impurity are necessary along with experimental studies. In this work, effects of plasma configuration and parameters on the impurity dynamics and deposition are investigated.

Monte Carlo simulation was carried out by using ERO code [1] with modification for LHD [2]. Hydrogen plasma profiles such as density, velocity and temperature of background plasmas are calculated by a 1D two-fluid model along a magnetic field line in a divertor leg with interaction with hydrogen neutrals [3]. Input heat flux and density at upstream of the divertor leg are given by arbitrary boundary values, $q$ [MW/m$^2$] and $n$ [m$^{-3}$], respectively. Increases of $q$ and $n$ correspond to increases of heating power and fueling, respectively.

Comparisons of deposition profiles of carbon are given in Fig. 2 as functions of position $x$. Contributions of physically sputtered carbon atoms and chemically sputtered methane molecules are shown in Fig. 2(a) and (b), respectively. Simulations were carried out for two different densities, $n = 0.4 \times 10^{18}$ and $1.0 \times 10^{18}$ [m$^{-3}$], and a fixed heat flux, $q = 10$ [MW/m$^2$]. The amount of deposition due to physical sputtering by high density plasma is less than that for low density one, while the amount of chemical sputtering does not changes. The decrease of physical sputtering is caused by decrease of impact energies of the background hydrogen ions.

In the poster, detailed behavior of impurity particles in the plasma and their effects on the deposition will be discussed based on parameter survey of the divertor plasma.

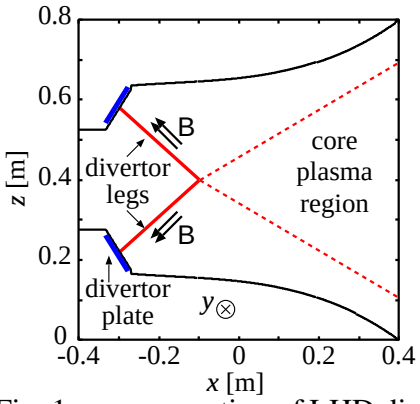


Fig. 1: a cross section of LHD divertor and simplified plasma configuration used in the simulation.

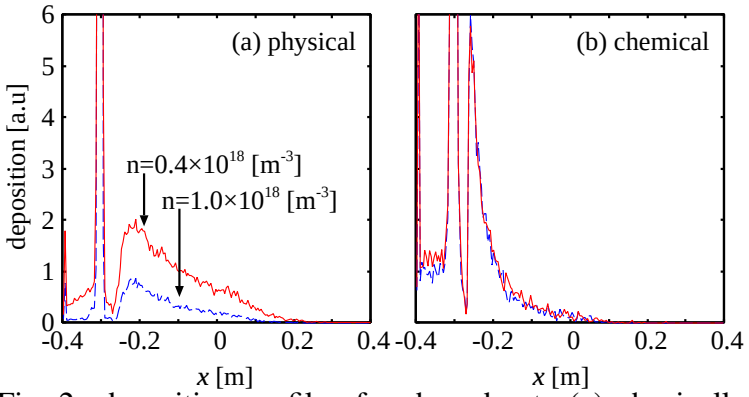


Fig. 2: deposition profile of carbon due to (a) physically sputtering and (b) chemical sputtering. Red solid and blue dashed lines correspond to low and high density cases.

[1] A. Kirschner *et al.*, Nucl. Fusion **40**, 989 (2000)
[2] G. Kawamura *et al.*, *Analysis of carbon deposition on the first wall of LHD by Monte Carlo simulation*, submitted to Contrib. Plasma Phys.
[3] G. Kawamura *et al.*, *1D fluid model of plasma profiles in the LHD divertor leg*, accepted for publication in J. Plasma Fus. Res. Series