§24. Observation of Plasma Response after Impurity Pellet Injection in CHS

Shirai,Y .(Grad. Univ. Advanced Studies)
Morita, S., Goto, M., Idei, H., Inoue, N.,
Kubo, S., Matsuoka, K., Minami, T.,
Okamura, S., Osakabe, M.,Sakamoto, R.,
Tanaka, K., Yoshimura, Y., and CHS group

Study of the particle transport characteristics is important in understanding a mechanism on the plasma performance, which is a critical issue in Large Helical Device (LHD) with well-defined divertor structure. This investigation has been experimentally done using gas puffing and laser blow off techniques until now. These methods, however, do not qualitatively give any exact results on the injected particle number. In addition, since a distance from a diagnostic port to the plasma is nearly 3 m in case of LHD, the application of such methods to LHD involves some difficulties. Then, we are now preparing the impurity pellet injection for the LHD diagnostics. The pellet experiment has been preliminarily done in CHS using a prototype injector.

We study the NBI and ECH plasma responses after pellet injection with hydrocarbon, aluminum and stainless steel spheres in CHS. Typical results for the hydrocarbon pellet (0.274 mmϕ) injection into the NBI and ECH plasmas are shown in Figs.1 and 2. It is shown that the plasma stored energy increases in NBI plasma after the pellet injection. However, there is no increment in ECH plasma. The radiation loss becomes constant at P_{rad}=90 kW after the rapid increase in the NBI plasma, while it goes up to 130 kW in the ECH plasma.

In case of CHS ($V_p \sim 0.8m^3$), it is found that the NBI plasma collapses by hydrocarbon pellet injection with a size larger than 0.4 - 0.5 mmϕ. To study a relation between the size and kind of injected impurity pellets and the plasma collapse, a decay time until the plasma current termination (Δt) is observed as a typical indication of the collapsing plasma. Figure 3 shows that the decay time becomes short for the injection with bigger size or higher Z impurity pellet. Here, it is found that the plasma current begins to decrease after the injected impurity pellet was completely evaporated and the plasma density begins to increase.

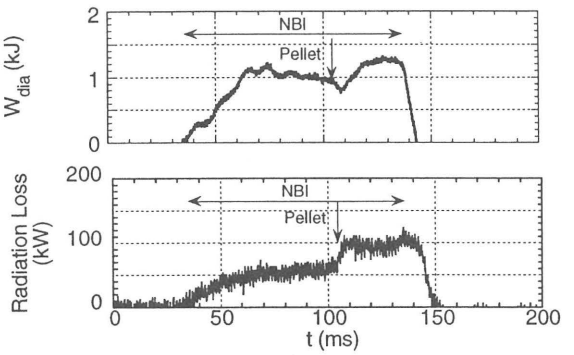

Fig.1. Time evolution of plasma stored energy and radiation loss with hydrocarbon pellet injection in the NBI plasma.

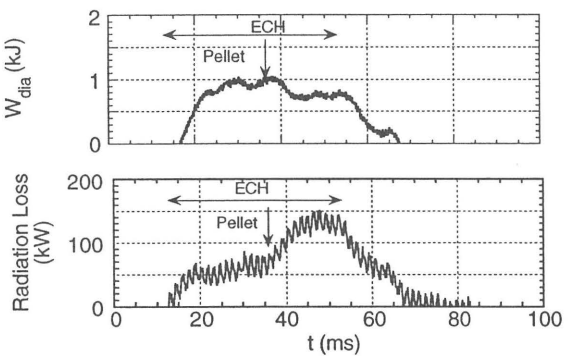

Fig.2. Time evolution of plasma stored energy and radiation loss with hydrocarbon pellet injection in the ECH plasma.

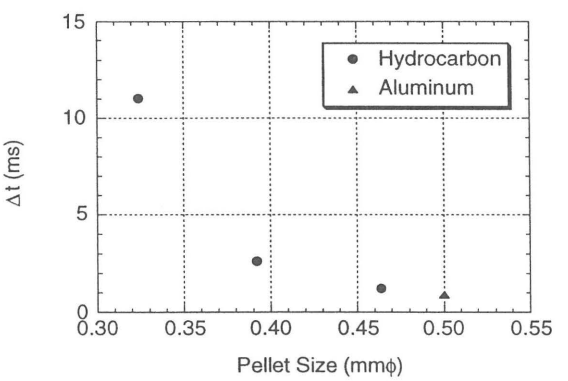

Fig. 3. Plasma current decay time after impurity pellet injection with hydrocarbon and aluminum spheres.