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Development of a Double-barreled Tracer-Encapsulated Solid Pellet (TESPEL) injection system for LHD*

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Various dynamic behaviours, such as L-H/H-L transitions and formations of internal transport barriers, have been observed in magnetically confined high temperature (MCHT) plasmas. It is highly important to study the impurity transport in such different plasma transport regimes for acquiring the comprehensive understanding of impurity transport in the MCHT plasmas. External impurity injection techniques have been utilized in order to study the impurity transport in the MCHT plasmas. One of such injection techniques, a laser blow-off (LBO), can inject the impurities repetitively into a single discharge, and then the impurity transport study can be performed efficiently by using the LBO. On the other hand, a tracer-encapsulated solid pellet (TESPEL) injection technique [1 - 3], which has been developed by our group, could only inject a single TESPEL into a typical plasma discharge (e.g., a typical duration of the LHD discharge ranges approximately from 3 seconds to 6 seconds).

In order to perform the impurity transport efficiently by using the TESPEL, a double-barreled TESPEL injection system was newly developed and installed for LHD. The new double-barreled TESPEL injection system consists of two TESPEL holding disks equipped with an individual fast-acting high-pressure gas valve and a three-stage differential pumping system shared with each TESPEL injection line. The TESPEL injection time in each TESPEL injection line can be set individually. The final guide tubes of each TESPEL injection line converges on an injection port (ICF 152) on LHD, which is on the equatorial plane of LHD. And thus, a single TESPEL ablation diagnostic can observe the ablation emissions from the TESPEL injected through each injection line of the double-barreled TESPEL injection system. In this contribution, the detailed design, the achieved performances of the new double-barreled TESPEL injection system will be presented and discussed.

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References

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