Initial Results on Impact of Background Hydrogen Isotope on Impurity Behavior in the EC-heated LHD plasmas

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A first assessment of the impact of background hydrogen isotope on the impurity behavior in EC-heated plasmas of the LHD has been performed. In the case of Hydrogen (H) plasmas, no impurity accumulation has been observed up to 3.2 x 10^{19} m^{-3} as a line-averaged electron density n_{ebar} with 2.1 MW ECH. The plasma was generally terminated as intended. On the other hand, in the case of Deuterium (D) plasmas under the similar condition, the n_{ebar} of 3.0 x 10^{19} m^{-3} with 1.7 MW ECH, a plasma radiation suddenly started to increase, and then the plasma was finally collapsed. During this event, there is no external fueling. This is a clear indication of the occurrence of impurity accumulation, which can be also supported by the temporal behavior of the intensity of line emissions from highly-ionized impurities externally introduced into the core plasmas. As shown in Fig. 1, the decay time of the Li-like intensity from the Vanadium impurity ion, which was introduced into the core plasma by the TESPEL method [1], in such high-density D plasma more than doubled (0.848 s → 1.812 s), as compared to that in the similar-density H plasma. And, in comparison with the H plasma, the rise time (time required to reach maximum) of the Vanadium Li-like intensity in the D plasma is also increased. In general, the rise and decay time of the line emission from the highly-ionized impurity reflect mainly the diffusivity and convection velocity, respectively. Therefore, the experimental result clearly indicates that such high-density D plasma has a lower impurity diffusivity and larger impurity inward convection velocity, as compared with the H plasma under the similar condition.

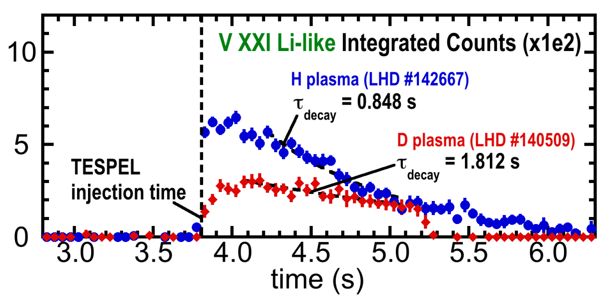

Fig. 1 Temporal evolution of Vanadium Li-like integrated counts measured with a VUV spectrometer.

[1] S. Sudo and N. Tamura, Rev. Sci. Instrum. **83** 023503 (2012).

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