§2. Spectra of Hα Lines and Cs Lines from the Negative Ion Sources during NB Injection

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High-performance negative-ion source requires further improvement to achieve reliable long-pulse high-power capability. The velocity spectra of the negative ion based neutral beams with doppler-shifted Hαspectroscopy, as well as the effectiveness of the spectroscopy have been studied / collaborated[1]. In the 9th experimental cycle, the spectra from a beam-line light as well as plasma source light have been accomplished newly by a switching unit controlled remotely to six optical-fibre channels.

The velocity distribution profiles during long-pulse LHD-NBI injection over the course of 74s ~ 128s long-pulsed beams with reduced power were demonstrated. In Fig.1, intensity of the Doppler-shifted Hα profile with the full energy peak reduces gradually along with beam pulse duration. When a plasma grid actively cooled is applied, this permits efficient H^- production at a constant level for pulses up to ~70s in 128s NB(sn56208), while the standard PG with a little conduction cooling at the PG periphery keeps constant for 10~30s in 74s NB(sn48818). Scaled-up profiles of the latter spectra suggested that by about 30s cesium has migrated from the high-temperature PG portions to the lower-ones[1].

The Doppler-shift spectroscopy system was used to measure cesium lines from the source plasma in standard LHD-NNBI injection. Interestingly, we found in Fig.2 that both the amount of CsI(Cs^0) line and CsII(Cs^+) line in the source plasma rose sharply when beam acceleration began, and continued high. It was considered in Fig.3 that this was because the cesium was sputtered off by the back-streaming ions, as was reported in the 6th Joint Conference for Fusion Energy[2].

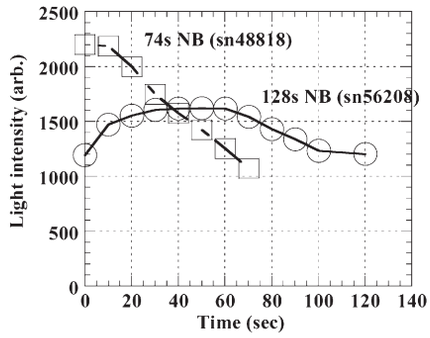

Fig. 1 Temporal dependence of H^- production during long-pulse injection. With an actively cooled PG in 128s injection. With a little conduction cooling PG in 74s one.

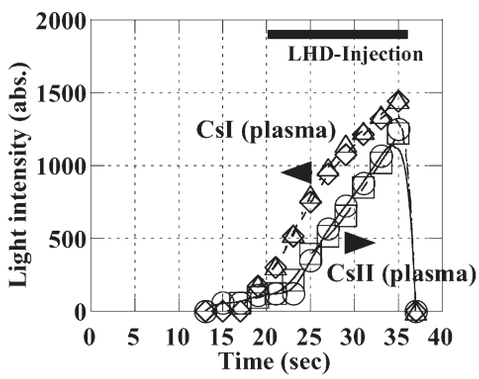

Fig.2 Temporal dependence of CsI(Cs0) and CsII(Cs+) line intensity from plasma source during the NB injection.

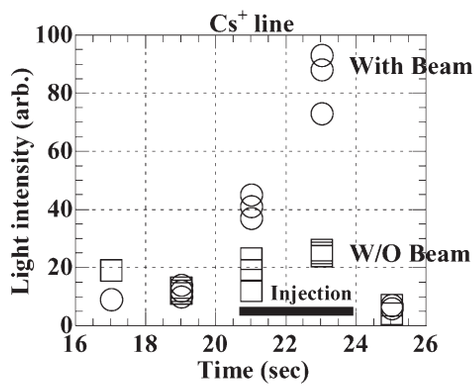

Fig.3 Temporal dependence of CsII(Cs+) line intensity with- or without beam acceleration voltage.

Reference

1) Y. Oka et al., Rev. Sci. Instrum. **77**, (2006)03A538.
2) Y. Oka et al, in Proc. 6th Joint Conference for Fusion Energy, Toyama, JPN, Jun.13 2006