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Improvement of Accelerator of N-NBI on LHD

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Three negative-ion-based NBIs (N-NBI), which are called NBI #1, #2, and #3, have been operated on the Large Helical Device (LHD) for plasma heating. Among them, NBI #1 has a different accelerator design with the multi-slotted grounded grid (MSGG) and injects the neutral beam of more than 6 MW with higher stability [1]. The others use the multi-aperture grounded grid (MAGG) and the injection power is limited to around 5 MW. One of the main advantages of the ion source of NBI #1 is a higher voltage holding capability. After the ion-source conditioning, the achieving acceleration voltage is in almost the same for three N-NBIs, but in NBI #2 and #3 the electrical breakdown takes place more frequently. We have suspected that the lower voltage holding capability of NBI #2 and #3 relates to the surrounding structures of the GG support and/or the GG structure itself.

To improve the voltage holding capability on NBI #2 and #3 we modified the surrounding structures of the GG support of NBI #3 and also applied the MSGG instead of the MAGG. In the experiment, we found the improvement in the voltage holding capability. In addition, the heat loading on GG reduced by 40% and the arc efficiency, which is defined as the ratio of the acceleration current to the arc power, increased without any modification of the plasma source. In the presentation, the beam optics with the MSGG will be discussed in detail together with above topics.

References

[1] K. Tsumori, M. Osakabe, O. Kaneko, Y. Takeiri, K. Nagaoka *et al.*, Rev. Sci. Instrum. 79, 02C107 (2008).