



Contribution ID: 53

Type: **Invited Oral**

Difference of Co-Extracted Electron Current and Beam Acceleration in a Negative Ion Source with Hydrogen-Isotope Ions

Friday, 24 September 2021 08:30 (30 minutes)

Improvement of the performance on a hydrogen/deuterium negative ion source for a nuclear fusion device are reported. In particular, the suppression of the co-extracted electron current, I_e , is an important issue to ensure the stable beam acceleration. Improvement of the I_e has been confirmed by optimizing the magnetic field of the electron deflection magnet in the extraction grid. The mismatch of beam deflection angle will be verified in 2021. Other two methods for reduction of the I_e were validated. First method is an outer iron yoke. The ratio of the I_e to the deuterium negative ion current, approximately I_e/I_{acc} decreased by 0.1 compared with that in hydrogen. Second method is an electron fence (EF) whose rods are set between the rows of apertures on the plasma grid. The I_e/I_{acc} was greatly improved from 0.7 to 0.25 in deuterium. These attempts have improved the total deuterium injection beam power of 8.4 MW by three negative ion based NBIs.

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Funding Information

NIFS-ULRR702

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Track Classification: Ion sources for fusion