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P4.022 Design of the Large Current Hydrogen Negative Ion Source by using Sheet Plasma

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Production of negative ion plays an essential role in Neutral Beam Injection (NBI). Research on a cesium-free negative ion source using sheet plasma has been carried out. The sheet plasma is suitable to produce negative ions because the electron temperature in the central region of the plasma is as high as 10 -15 eV, whereas in the periphery of the plasma, a low temperature of a few eV is obtained. Therefore, it is considered that high density production of negative ion is possible in sheet plasma. The extraction of hydrogen negative ion beam from high density sheet plasma using TPD-Sheet IV had been succeeded. We have developed the large current hydrogen negative ion source to get more beam current from sheet plasma. The developed device has been increased in size to get negative ions from larger area of sheet plasma. The length of the extracting region is 132mm and width is 33mm. The device has 48 holes on the extracting electrodes. Since increasing of size of the device induces increasing of distance of magnetic coils, uniformity of magnetic field force is required. Therefore, the irons are put beside two coils which are both ends of extract device. The uniformity of magnetic field force is maintained about 10 % better than without irons. In addition, we have calculated the production of negative ions to set extract device at best region. From the calculated results of the production of negative ions using 0-dimensional rate balance equations, the extract device is set at about 14 mm above of center of the sheet plasma.

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