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Analysis and experimental study of impedance matching characteristic of RF ion source on neutral beam injector

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The neutral beam injector (NBI) is one of the plasma heating methods on fusion device, which has highest plasma heating efficiency and the clearest heat physical mechanism. The high power ion source is one of the key parts of NBI system. Compare to the traditional hot cathode ion source, the radio frequency (RF) ion source have many merits, such as higher lifetime because of no filaments, simpler mechanical structure, lower cost due to the cheaper power supply, and power supply on ground potential due to a transformer used. It is also the reference ion source for ITER. The impedance matching is the important unit for the RF ion source, which is used to match the parameters of the RF generator and ion source antenna. It can helps to transfer the maximum RF power to the RF antennal of ion source and gets stable plasma. Due the plasma impedance will be changed before and after the plasma generation, the impedance characteristic is not easy to be calculated and measured. So, it also need more experimental study. In this paper, the impedance matching unit was analyzed and designed according to the principle of RF ion source. The matching characteristic was studied during the experiment, and got the best impedance matching characteristic. It also verified the design of impedance matching unit. Based on the results of impedance matching study, high RF power of 50 kW was coupled into the plasma and got long pulse stable plasma discharge.

Eligible for student paper award?

No

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