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R&D of Radio Frequency Ion Source for Neutral Beam Injector in ASIPP

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The radio frequency (RF) ion source has many merits compared to the traditional arc based ion source because of it has long lifetime due to no filaments. It has the potential to be operated in steady-state. In order to meet future development needs of neutral beam injectors, a radio frequency ion source was designed and developed in Institute of Plasma Physics, Chinese Academy of Sciences (ASIPP). So far, the RF ion source with single driver (diameter of 20 mm and depth of 12 cm) and with two drivers were developed. The drivers have the same structure, a turns coil, Faraday shield with water cooling and quartz insulator.

A radio frequency ion source test bed was also developed for the ion source performance tests. It contains a 50 kW RF generator with 1 MHz frequency, a matching network, a RF power dummy, a water flow calorimeter (WFC) system, a control system and gas pumping system. The RF plasma can be generated with higher gas pressure or start filament. High power of 50 kW was coupled into the ion source using the matching network. The RF power deposited in the RF driver was estimated by the WFC system leading to the optimization of driver for long pulse operation. More RF ion source design details and tests results will be presented in this paper.

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