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Experiment of Two Frequency Heating for Production of Multiply Charged Ion at Compact ECR Ion Source

Several research and developments have been performed at a compact ECR ion source (Kei3) with a fixed magnetic field for high-energy carbon-ion radiotherapy. In order to improve the beam current of multiply charged ions such as the neon and the argon, the two microwave frequency heating method was tested. Microwaves are introduced from the vacuum box on the upstream side of the plasma chamber through the rectangular waveguide of the WR-90. A traveling wave tube (TWT) amplifier made by NEC (LD79X75A1) is used as the microwave source. The WR-75 waveguide is also introduced from the upper part of the upstream vacuum box and installed on top of the existing WR-90 waveguide. A beam test with O, Ne, and Ar was performed in order to confirm the effect of two microwave frequency heating. In this test, we focused on O₆₊, Ne₇₊, and Ar₉₊ ions. We checked the microwave frequency at the XTRD-300IJ, dependence of the microwave power at the LD79X75A1 and charge state distributions of O, Ne and Ar.

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