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Experiment of Highly Charged Ion Production by Changing the Microwave Injection Position at Compact ECR Ion Source

Kei3 is a prototype of compact ECR ion source developed for various ion production at QST-NIRS. It has confirmed that Kei3 has an ability to produce highly charged heavy ion, for example, carbon, neon and argon, but the beam current was not high enough. To improve this situation, we optimized microwave frequency and injection position in the plasma chamber.

Microwave has a large effect to production of ion, the injection efficiency to ECR plasma is a key to obtain high current beam.

In this study, we measured Ar⁴⁺ beam current by moving the injection position 2mm step along beam axis from peak of axial magnetic field. We also measured it when microwave frequency was varied from 9.75 GHz to 10.00 GHz in 0.01 GHz step. Microwave was transmitted by coaxial cable, and it was injected through antenna. The dependence of microwave frequency and antenna position on beam current was measured in this experiment. Coaxial cable was set at r=18 mm to prevent damage due to heat input by the plasma.

The beam current was not observed at the start position, but it increased periodically along the injection position. The maximum beam current was 26.8 μ A observed at microwave frequency of 9.84 GHz and 45 mm inner position of the peak of magnetic field. It was 1.8 times larger than 5 mm inner position of the peak. As a result, the injection position of microwave should at the inner position of peak of magnetic field for more efficient highly charged ion production.

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Yes

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