FIRST OPERATION OF ECR ION SOURCE AT KUT

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To study atomic physics and nano scale manufacturing by using the ion beam, NANOGAN (10GHz), which is a ECR ion source developed by PANTECHNIK, has been installed in Kochi University of Technology (KUT). We have gotten the first beam extracted from ECRIS in January of 2003.

NANOGAN has been built with the beam transport system and the irradiation system at KUT. The voltage up to 30 kV and 100 kV are applied to extract and accelerate the ion beam, respectively. To perform mass analysis, a dipoler magnet was installed in the beam transport system.

To check the beam extraction, the beam extracted from NANOGAN into which Ar gas was fed was observed as a function of the voltage for the beam extraction. The power of RF (P_{RF}) applied to ECRIS was valid over the range 10 – 24 W and the beam current was measured by the Faraday cup. Since the beam current was measured without mass analysis in this measurement, all of ions extracted from NANOGAN were observed. The typical results are shown in Fig. 1. The solid line is the fitting results optimized by power function, $I = AV^B$. The index B = 1.61(10) is consistent with Child-Langmuir equqtion. And index B does not depend on P_{RF}. It is implied from this result that the extraction system works well.

To confirm the ionization, the mass spectrum of the beam extracted from NANOGAN was observed. Ar gas and the air were fed into NANOGAN and P_{RF} was valid over the range 8 – 24 W. The beam was analyzed by the dipole magnet and the beam current was measured by the Faraday cup. The mass spectrum measured at P_{RF} = 24 W is shown in fig. 2. Ar ions shown in fig. 1 with thick lines and other ions, C^{+1}, C^{+2}, N^{+1}, O^{+1}, were detected. Furthermore, molecular ions were detected. Ar ions and other ions are produced from Ar gas and air, respectively. It is confirmed that all of atoms and molecules, which are fed into NANOGAN as a gas, can be ionized.

It is concluded from the above results that the ECRIS system build at KUT works normally and has a possibility of an application to the various fields. In the next step, we will get the ion beams in higher charge states by applying more intense RF.

fig. 1

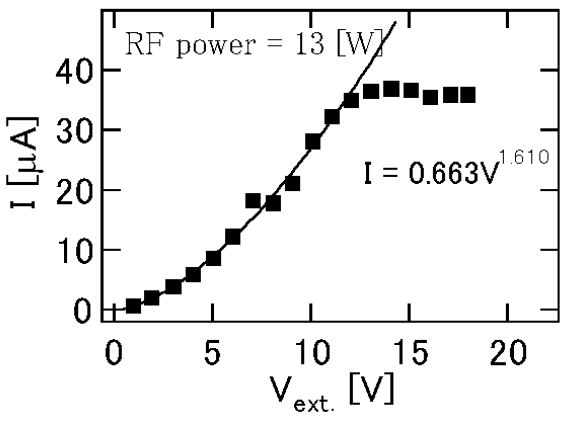

fig. 2