II. 2. Effects of RF Voltage and Cooling of RFIGISOL2

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Radio Frequency Ion Guide Isotope Separator On-Line (RFIGISOL) has been designed and developed to study the nuclear structure of neutron-rich nuclei at the medium-mass region far from the beta stability line. The upgraded RFIGISOL2 has been recently designed and developed to obtain higher yield of mass-separated unstable nuclei at CYRIC[1,2].

We report the effects of RF voltage and the performance of cooling of upgraded RFIGISOL2. The details of design and specifications of RFIGISOL2 are presented in this volume[2].

In order to study the effect of RF-voltage in RFIGSIOL2, we chose stable xenon, which are mixed in helium buffer gas and are ionized by the 50 MeV proton beam of the 930 cyclotron. Stable xenon ions are an adequate probe instead of fission products. Xenon ions are transported by the DC and RF electric fields in the RFIGISOL chamber. Then, they are extracted from an exit hole, mass separated by the magnetic field and detected with a channeltron.

Figure1 shows the relation of the yield of xenon ions and RF voltage of carpet electrodes, which are consist of 230 circular electrodes. The frequency of RF field was 3.65 MHz. The carpet electrodes to supply the DC voltage are separated into two groups, the inner and the outer. The voltage of the inner one from the center (the exit hole) to 30 mm was 13 V and the voltage of the outer one from the 30 mm to 110 mm was 10 V. The mass-separated xenon ions have drastically increased from 50 Volt region of RF voltage in

peak to peak (Vpp). The extraction yield of xenon ions at Vpp = 90 V is about 1000 times higher than the yield without RF voltage.

Figure 2 shows the mass spectra of light ions with coolant temperatures at 20°C (top) and -13°C (bottom), respectively. These spectra reflect the impurity concentration in the buffer gas. The electric field was not applied in this experiment. We can see the two prominent tendencies by the effects of cooling down. The first one is the disappeared peaks of A > 20 , and the second is that the yield of A = 16 ion ($^{16}O^{+}$) was reduced to about 1/10. Figure 2 shows the effect of cooling by the drastic reduction of molecule contamination.

References

1) Sato N., Master Thesis, Tohoku University (2006).
2) Miyashita Y., in this report.

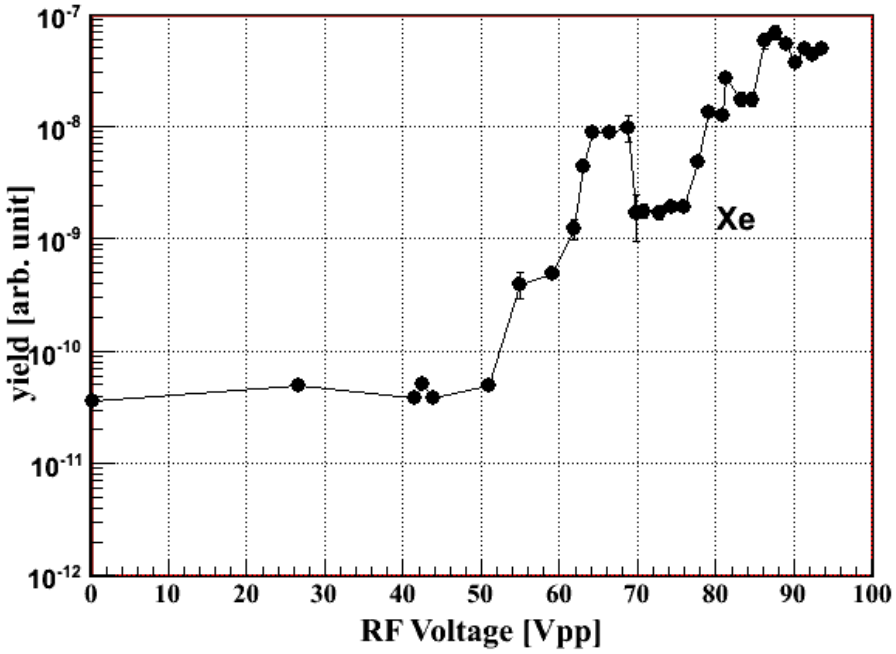

Figure 1. The effect of applying RF voltage.

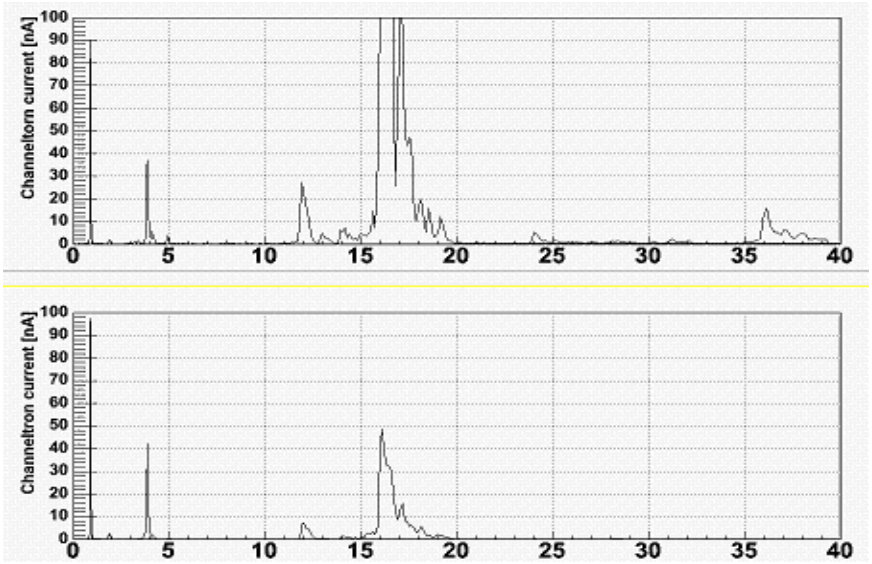

Figure 2. Mass spectrum of impurity molecules.