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Charge Breeding Experiment of Stable Ion Beams in EBIS Charge Breeder for RAON Facility

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The Electron Beam Ion Source (EBIS) charge breeder is utilized to produce highly charged ions in Isotope Separation On-Line (ISOL) system of Rare isotope Accelerator complex for On-line experiments (RAON). Offline and online tests of EBIS are performed by using stable ion beams, which are Cs, Sn, and Na. $^{133}\text{Cs}^{1+}$ ions from a test ion source were injected into the EBIS to measure the breeding effect with the electron beam whose current can be used up to 2 A in various breeding times. The resultant relative abundance of $^{133}\text{Cs}^{27+}$ was 23.9 % and the extraction energy per charge was 49.3 keV/q. A charge breeding test of ^{120}Sn ions was also carried out. The Sn ions were extracted from a laser ion source of the ISOL system. The charge fraction of $^{120}\text{Sn}^{24+}$ was 23.7% and the energy per charge with 50 keV/q, and the ions were transported to the end of ISOL beam line which is the start position of reacceleration. These results fulfilled the input beam condition of the RFQ accelerator ($A/q < 6$ and 10 keV/u). To find the operating condition for light ions, we are performing the optimization with Na ions.

Additionally, the highly charged ion beam with various pulse lengths is required for some experiments, so the length of the beam from the EBIS should be possible to be determined. In the experiment, $^{133}\text{Cs}^{27+}$ ions charge-bred by the EBIS are extracted with a pulse length up to 10 ms (FWHM) by applying the time-varying voltage on drift tubes in the breeding section when they eject.

The main experimental results will be described in this presentation.

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