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Production of Intense Vanadium Ion Beam for Super-Heavy Element Research Experiments

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Recently, production of highly charged medium mass heavy ion beams, such as Titanium (Ti), Vanadium (V), and Chromium (Cr) ions, are strongly demanded for the synthesis of new elements. At RIKEN, especially, production of intense 51V^{13+} ion beam for long term was strongly required for synthesis of the new element ($Z=119$). For this purpose, we constructed new superconducting electron cyclotron resonance (ECR) ion source and produced intense 51V^{13+} ion beam. For production of intense beam effectively, optimization of both consumption rate of the material and microwave power are very important. Therefore, we carefully studied the effect of not only microwave power, but also material consumption rate on the beam intensity systematically. Consequently, we produced about 1 emA of V^{13+} ion beam at the injected microwave power of about 3.5 kW at the extraction voltage of 12.6 kV. Additionally, to optimize the transmission efficiency of the beam in the accelerator, we studied the emittance size under the various conditions. In these test experiments, we observed that the emittance of V^{13+} ion beam was strongly dependent on the extraction current. It may be due to the space charge effect. In this paper, we report the experimental results of V^{13+} ion beam production under the various conditions (support gas pressure, consumption rate, microwave power) and the emittance measurements.

Funding Agency

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