

Gas flow simulation of a gas cell of IGISOL

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A gas flow simulation of a gas cell of ion guide isotope separation on-line (IGISOL) was given for an improvement of an on-line laser ion source.

The on-line laser ion source to employ a resonance ionization scheme has been developed at GARIS/IGISOL facility in RIKEN cyclotron laboratory to investigate the nuclear charge radii and electromagnetic moments of unstable nuclei in the refractory element region.^{1,2)} The ion source was tested for the short lived Hf isotopes produced with ^{nat}Sn target using ^{48}Ti beam from RIKEN Ring Cyclotron.³⁾ The Hf isotopes are collected at the IGISOL gas cell with gas-filled recoil isotope separator (GARIS), then thermalized and neutralized in the gas cell filled with a buffer gas of He and Ar. The Hf atoms are selectively ionized by two-color lasers, and extracted together with the gas flow through a nozzle.

However, in this experiment, a yield of Hf isotopes was too small because a translation efficiency of the gas cell was very low.⁴⁾ It seems that the low efficiency was caused by collisions of Hf particles with a wall of the gas cell and impurity

molecules in the buffer gas.

By the simulation of the gas flow, we can obtain a stay time and a motion of the Hf particles in the gas cell. These are needed to estimation of the efficiency of the gas cell and the necessary purity of the buffer gas.

We used a flow simulation software FUJITSU/ α -FLOW which is an application software on the VPP-500. Until now, using a rough model, there is no strange gas flow. However, we can not simulate exactly in the region near the nozzle because we use a calculation code for incompressible fluid. In the future, we make the model in detail, and use the code for compressible fluid.

References

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