Laser Ablation Ion Source for RFIGISOL

II. 2. Laser Ablation Ion Source for RFIGISOL

Hoshino S.[1], Wakui T.[2], Tateoka M.[1], Miyashita Y.[1], Shimada K.[2], Ishida T.[2], Sato N.[1], Nagano T.[1], Ouchi H.[1], and Shinozuka T.[2]

[1]*Department of Physics, Tohoku University*
[2]*Cyclotron and Radioisotope Center, Tohoku University*

The radio-frequency ion guide isotope separator on-line (RFIGISOL) has been developed for the studies of nuclear properties such as masses, lifetimes and nuclear moments of neutron rich nuclei in the medium mass region[1,2]. The RFIGISOL has a large volume gas cell and DC and RF electric fields which bring an efficient extraction of unstable nuclei of interest. In particular, it should be powerful in extracting and separating refractory elements.

For test experiments without beams from the accelerator (off-line), we have installed a laser ablation ion source in the RFIGISOL. The ion source is placed inside the gas cell instead of a Uranium target for on-line experiments, as schematically shown in Fig. 1. A metallic target of a refractory element is put at one end of a rod. A lens for focusing laser light on the target is also mounted on the rod. The lens is usually placed at the outside of the gas cell. By changing the lens position along the rod, we can focus the laser light on the target. By moving the rod along the rod axis, on the other hand, we can change the target position without changing the distance between the lens and the target. A Faraday cup (FC) is used for monitoring ion currents produced by laser ablation. The FC is mounted on the end of another rod in the gas cell. The position of the FC can also be changed by moving the rod along the rod axis.

Figure 2 shows a picture of a vacuum flange through which the rods are inserted. The flange has three glass windows for laser light, for observing a laser spot on the target, and for monitoring a FC position in the gas cell.

A Nd:YAG laser is used as a light source for the laser ablation. The laser is a pulse laser having a power of 100 mJ/pulse, 5 ns-pulse width and the repetition rate of 20 Hz. By using the laser, we can measure the time profile of the extracted ions. Figure 2 shows a

measured time profile of Mo ions which are extracted from the gas cell and accelerated to 30 kV. The measurements are carried out for different gas pressure in the gas cell. The extraction time is increased with increasing the gas pressure.

It clearly demonstrates that the ion source is useful for producing ions of refractory elements. The ion source will be used for studying the ion extraction time and efficiency, for confirming the effect of electric fields, and for optimization of the RFIGISOL system before on-line experiments.

For on-line experiments, we are planning to measure nuclear moments of the isomers by means of the time-differential perturbed angular correlation (TDPAC). A new detector system including BaF_2 has being installed and tested for the TDPAC measurements. The first on-line TDPAC measurement will be carried out in 2008.

References

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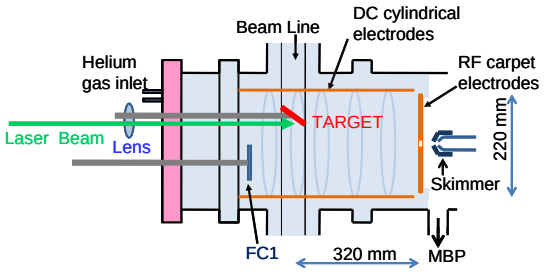

Figure 1. A schematic view of the laser ablation ion source. A metallic target of refractory element is placed on top of a rod. A lens for focusing laser light is mounted on the same rod. A faraday cup for measuring ion currents is attached on top of another rod. Both the target and the FC is movable inside the gas cell.

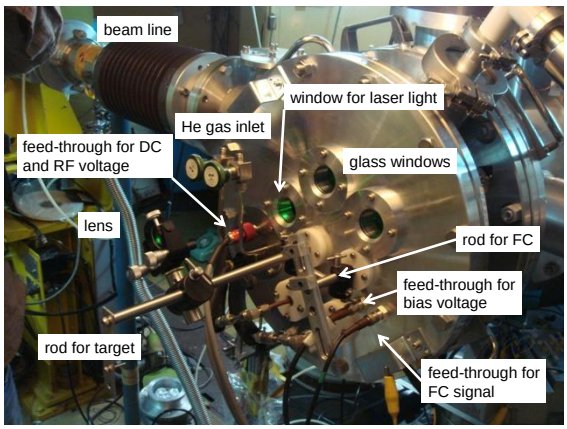

Figure 2. A picture of the flange used as a "lid" for the gas cell. The rods are inserted into the gas cell through the flange.