MAIN MAGNETIC FOCUS ION SOURCE: DEVICE WITH HIGH ELECTRON CURRENT DENSITY

Ovsyannikov V.P.[1], Nefiodov A.V.[2], Stegailov V.I.[1], Tyutyunnikov S.I.[1]
[1] *Joint Institute for Nuclear Research, Dubna, Russia;* [2] *Petersburg Nuclear Physics Institute, National Research Center "Kurchatov Institute", St. Petersburg, Russia*
E-mail: v.ovsyannikov@yandex.com

The Main Magnetic Focus Ion Source (MaMFIS) is a compact room temperature device of the next generation. The MaMFIS technology is based on the use of the local ion traps, which appear in crossovers of rippled electron beam [1, 2]. The current density j_e of the focused electron beam can reach extremely high values of about 20 kA/cm^2. Thus far a whole family of pilot models of ion source has been developed and tested. In recent experiments performed in Veksler and Baldin Laboratory of High Energy Physics at JINR, the x-ray spectra emitted due to the electron radiative recombination into the M- and L-shells of Ar, Ir, Ce and Bi ions are recorded (curve in Fig. 1).

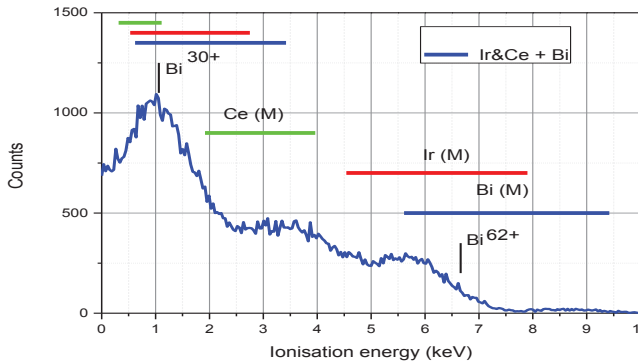

Fig. 1. Spectrum of radiation recombination of High Charge Ions of Ir, Ce and Bi.

A very promising application of the ion source is the charge breeding of short-lived radioactive isotopes. The deep ionization of electron shells allows one to eliminate the conversion decay channels. In this case, the life-time of nucleus can be increased by many orders of magnitude, so that the use of mass spectrometry become feasible. The extremely high electron current density realized in the MaMFIS results in very short ionization times and efficient production of highly charged ions of heavy elements. In particular, the time required for complete ionization of argon ions is about 1 ms, which is consistent with the current density $j_e \sim 20$ kA/cm^2.

1. V.P.Ovsyannikov and A.V.Nefiodov // Nucl. Inst. Meth. B 2016. V.370. P.32.
2. V.P.Ovsyannikov, A.V.Nefiodov and A.A.Levin // J. Physics: Conf. Series 2017. V.798. P.012170.