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A CRYOGENIC GAS-FILLED ION STOPPING CELL AS AN INSTRUMENT FOR EXPERIMENTAL STUDY OF HEAVIEST NUCLEI.

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Mass measurement allows to determine the full binding energy of the nucleus - the integral characteristic of all atomic and nuclear forces which is the key for solving the fundamental physics problems, which includes nuclear physics, astrophysics, physics of fundamental interactions and symmetries, neutrino physics. High precision mass spectrometry could solve the problems of proton and neutron shells location in the nucleus (precision $\Delta M/M$~10-6), the study the nuclei deformation phenomena, searching of so-called "halo-nuclei", the correct description of the heaviest elements formation during astrophysical *r*- and *rp*-processes of fast neutron and proton captures respectively (precision $\Delta M/M$~10-7).

For this reason, a new installation for the high precision mass-spectrometry of heaviest nuclei is being built at the Flerov Laboratory of Nuclear Reactions, JINR, Dubna. It will include new target block, gas-filled separator for the reaction products, cryogenic gas-filled ion stopping cell (so-called "Cryocell"), radio-frequency quadrupole transport system and the multi-reflection time-of-flight mass-spectrometer (MR-TOF-MS). This installation could provide mass measurements with the precision of about $\Delta M/M$~10-6. "Cryocell"is one of the most crucial component of the installation. This is a powerful instrument for the fundamental research due to its high conversion coefficient of the fluxes of reaction products with heavy ions at energies 5-10 MeV/nucleon into low energy secondary beam and low extraction time. It could open the possibility to perform mass analysis of short-lived isotopes with the lifetime of 100 ms and more.

Main parameters of the "Cryocell":

• Length: 300 mm, diameter: 250 mm;
• Operating temperature: 40 K;
• Gas pressure at operating temperature: 5-7 mbar;
• Gas flow through the cell: ~1 Torr/l*s;*
• Stopping efficiency for ions: ≥70%;
• Extraction efficiency: ~30%;
• Extraction time: ~30-40 ms.

*The "Cryocell" operates at the cryogenic temperatures of about 40 K and filled with extra-pure helium gas with the constant flow through it of about ~1 Torr/l*s to avoid appearance of stable compound formation of ions with the atoms and molecules of additional mixtures. The tests of the cryogenic and electrode systems were performed already with success. The experiments of the residual gas analysis were also carried out and showed the full suppression of air components except hydrogen and neon at the temperature of 40 K. In the nearest plans is to perform a complex test with using of the internal source to determine the extraction efficiency, time and overall parameters. In this speech, a status of "Cryocell"will be revealed.

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