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Cryogenic gas stopping cell testing with alpha source and Monte Carlo simulations

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The new experimental setup for the high-precision mass measurement of the heavy and the superheavy nuclei is being built in the Flerov Laboratory of Nuclear Reactions (Dubna). The crucial part of the setup for stopping and thermalization of the reaction products is the cryogenic gas stopping cell (CGSC). The CGSC consists of the stainless steel outer and inner chambers. The outer chamber is at the vacuum pressure and works like the thermal insulation. It also reduces the radiation heat transfer to the inner chamber by the insulation foil. The temperature inside of the outer chamber is the room temperature (293 K). The inner chamber is filled by the helium buffer-gas and it is also platted from the outside by the copper for the homogenous distribution of the temperature. The inner chamber is cooled to the 40 K by the cryocooler. The set of the cylindrical and the conic electrodes are installed inside of the inner chamber. The isotopes for the testing of the CGSC is possible to get from the alpha source with the intensity below the minimally significant activity according to the radiation safety rules. There are stopped in the active volume of the inner chamber and guided by the electrical field to the supersonic nozzle and then extracted and filtered by the radio frequency quadrupole. The alpha source 227Th decays by alpha decay to the 223Ra, 219Rn, 215Po and 211Bi. The measuring is performed at the pressure 50 Torr for the room temperature (293 K) and the 5 Torr for the 40 K. The simulations of the extraction time from the CGSC were performed. The internal software using the Monte Carlo method and based on the SRIM and the Geant4 was used in the simulations.

Section

Design of new experimental facilities

Primary author: NOVOSELOV, Aleksey (FLNR JINR)

Co-authors: MAHEER, A. (Ain Shams University, El-Khalyfa El-Mamoun Street Abbasva, Cairo, Egypt); KOMAROV, A.B. (Joint Institute for Nuclear Research, Flerov Laboratory of Nuclear Reactions); ABAKUMOV, A.M. (Joint Institute for Nuclear Research, Flerov Laboratory of Nuclear Reactions); Dr RODIN, A.M. (Joint Institute for Nuclear Research, Flerov Laboratory of Nuclear Reactions); GULYAEV, A.V. (Joint Institute for Nuclear Research, Flerov Laboratory of Nuclear Reactions); GULYAEVA, A.V. (Joint Institute for Nuclear Research, Flerov Laboratory of Nuclear Reactions); PODSHIBYAKIN, A.V. (Joint Institute for Nuclear Research, Flerov Laboratory of Nuclear Reactions); KOHOUTOVA, Alena; OPICHAL, Antonin (Palacky University Olomouc); CHERNYSHEVA, Elena (FLNR JINR); KLIMAN, J. (Institute of Physics, Slovak Academy of Science); PECHOUSEK, J. (Palacký University Olomouc); KURKOVA, Nataliia (FLNR JINR); Dr KOHOUT, P. (Joint Institute for Nuclear Research, Flerov Laboratory of Nuclear Reactions); YUKHIMCHUK, S.A. (Joint Institute for Nuclear Research, Flerov Laboratory of Nuclear Reactions); STEPANTSOV, S.V. (Joint Institute for Nuclear Research, Flerov Laboratory of Nuclear Reactions); SALAMATIN, V.S. (Joint Institute for Nuclear Research, Flerov Laboratory of Nuclear Reactions); Mr VEDENEEV, Vyacheslav (FLNR JINR)

Presenter: NOVOSELOV, Aleksey (FLNR JINR)

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