Advanced probe diagnosis system development for the low-temperature plasma plumes investigation

Maystrenko D.A.[1,2,@] **and Shagayda A.A.**[1]

[1] State Scientific Centre of the Russian Federation—Keldysh Research Center, Onezhskaya Street 8, Moscow, 125438, Russia
[2] Moscow Institute of Physics and Technology, Institutskiy Pereulok 9, Dolgoprudny, 141701, Russia

[@] master030198@mail.ru

The work presents the simulation and experimental verification of a new method for measuring the ion energy distribution function and the fraction of double charged ions. Existing measurement methods require the geometric dimensions of the probes to match the parameters of the plasma being studied, which makes it impossible to perform accurate measurements with a single probe under different conditions. [1] [2] [3] The new HDR RPA presented in this paper allows measuring the energy spectrum of ions in a six-order-of-magnitude wider range of plasma concentration compared to a traditional gridded probe, with a maximum error of 1.5% in determining the energy peak. The new Wien filter can work with a sensitivity of 0.2% for the fraction of double charged ions in plasmas with ion energies ranging from 100 to 2000 eV. The paper presents the new simulation method of the probes' performance in plasma and the results of experimental verification of simulation in a range of plasma concentrations from 10^{12} to 10^{18} m^{-3}. The experiments have proven that the simulation method is correct and new probes work correctly.

[1] Groll C 2018 *Development of a plasma diagnostic system* (Ph.D. thesis)
[2] Hutchinson I 2002 *Principles of Plasma Diagnostics* (United States of America by Cambridge University Press)
[3] Kim S W 2002 *American Institute of Aeronautics and Astronautics* **39**(9) 904–909