**Characterization of ion beam generated by an anode layer ion source**

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Plasma technologies are widely applied in the processes of coating and modification of surface properties in many areas of industry and science, including electronics, mechanical engineering, and optics. Among the most versatile devices for the implementation of ion-plasma technologies are ion sources of various types, e.g. anode layer sources [1, 2]. The main parameters of such sources are the energy and mass distributions of ions in the generated beam. In most applications, a narrow energy spectrum of the beam is preferable, and a well-defined ion mass composition is necessary.

To characterize a custom anode layer ion source, we used a combination of separate mass-analyzer (MA) and energy-analyzer (EA). MA was an in-house magnetic sector equipped with specially designed extraction and detection systems [3]. The energy analyzer was a retarding field one, composed of three single-orifice diaphragms and collector. Prior to implementation, electric field distributions, ion trajectories, and instrument function of EA were modeled in COMSOL Multiphysics to optimize its dimensions and aperture sizes. With an initial ion energy in the range from 1500 to 2500 eV, the width of the instrument function of designed EA remains less than 10 eV, which we consider suitable.

The mass and energy spectra of ion beam were measured by both instruments. The experiments revealed presence of three groups of extracted argon ions: low-energy background plasma ions, ions with initial energy of ~ 100 eV, and the ions accelerated in the ion source, with peak energy corresponding roughly to half of the discharge voltage (~ 600–700 eV). The origin of ions groups and the energy spectra are discussed in detail.

References

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