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P04 - High voltage scanning ion microscope: beam optic and design

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This article focuses on a conceptual design of a high voltage ion microscope. This setup is a further development of compact ion microprobe. Probe formation after an ion source is the main distinction of the proposed design, like it is in electron microscopes. Traditional microprobes use only a small fraction of a beam current from the source. Most of it is lost on an object and angular collimators. Therefore, it is advisable to use high-intensity ion sources in the high-voltage ion microscope. A small amount of the source current will be compensated by more fully using and higher acceptance of the probe-forming system.

Constructively, the ion optical system is divided into two parts: the ion injector and the probe-forming system. The structure of the injector includes an ion source with a small emission aperture, a Wien filter, and an axial lens. The lens forms an output crossover of the injector and controls its size. This crossover plays an object collimator role function. The final formation of the beam is made by the probe-forming system. It consists of an accelerating tube and a multiplet of quadrupole lenses. Inclusion of an accelerating tube in the probe-forming system will reduce the size of the microprobe and improve its performance.

We studied the ion-optical properties of the proposed probe-forming system, taking into account the influence of the chromatic and third-order aberrations, energy spread of the beam at the exit of the injector, and the nonlinear properties of the probe-forming system. The possibility of using high-brightness ion sources of existing structures as part of the injector was considered. The design of a high-voltage scanning ion microscope based on optimization calculations was proposed, and the ion optical characteristics were determined.

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