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THE ELECTRON-OPTICAL SCHEME OF THE ENERGY ANALYZER OF SMALL-SIZED ELECTRON SPECTROMETER*

ZH.T. KAMBAROVA[1], A.O. SAULEBEKOV[2], K.B. KOPBALINA[3]

[1]*Buketov Karaganda University, Karaganda, Kazakhstan*
[2]*Lomonosov Moscow State University, Kazakhstan branch, Nur-Sultan, Kazakhstan*
[3]*Karaganda Technical University, Karaganda, Kazakhstan*

In this work, the calculation of the electron-optical scheme of the axially-symmetric electrostatic mirror-type energy analyzer based on a multipole electrode system is carried out. The field of the energy analyzer is designed as a superposition of the base cylindrical field and set of circular octupole coaxial with base field.

The authors of the work previously carried out the calculation and analysis of equipotential portraits of electrostatic octupole-cylindrical fields for different weight contributions of the cylindrical field and circular octupole in order to determine the electrode configuration of the energy analyzer [1].

The energy analyzer contains two coaxial electrodes: the inner electrode *1* has a cylindrical shape of radius r_0 and is under zero potential, the outer electrode *2* has a curvilinear profile and is under the deflecting potential U_0 (Fig. 1). A field that decelerates and deflects charged particles is created between the electrodes, which have the properties of an electrostatic mirror. The profile of the outer electrode *2* repeats the equipotential surface of the electrostatic octupole-cylindrical field.

The trajectory analysis of charged particles in field of the energy analyzer was performed on the basis of a numerical calculation method by using the CAE “Focus” software for numerical simulation of electron optics systems [2].

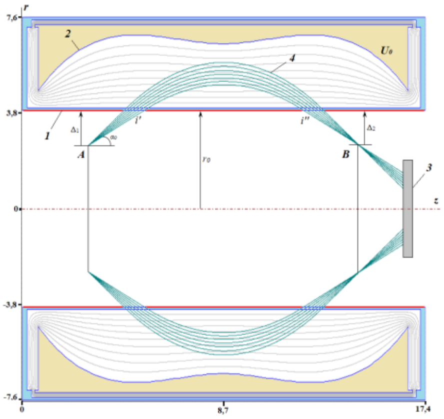

Fig.1. The electron-optical scheme of the energy analyzer: 1 - inner grounded cylindrical electrode, 2 - outer deflecting electrode, 3 - a position-sensitive detector, 4 - charged particle beam, *A* - ring source of charged particles, *B* - ring image, *i'* - entrance ring slit, *i''* - exit ring slit.

According to the scheme, the charged particles beam from the ring source *A* enters the analyzer field through the entrance slit *i'*, is reflected by the field, then returns to the zero potential region through the exit slit *i''* and is focused into the ring image *B*. Then the particles are registered by a position-sensitive detector *3*. Due to the curvilinear profile of the outer electrode *2*, the scheme provides a sharp 3rd-order angular focusing of charged particles near 36° with a divergence angle $\Delta\alpha=\pm6°$. The corpuscular-optical properties of the system are calculated. The energy analyzer is characterized by compactness, high focusing quality and energy resolution, and can be used to develop a small-sized highly sensitive electron spectrometer.

REFERENCES

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