ELECTRODYNAMIC TRAPS AS THE TOOL FOR PARTICLE DIAGNOSTICS, GAS FILTERING AND POWDERS SEPARATION

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The Paul traps were firstly developed as a tool for selective ion capturing and in the mass-spectrometry. Though these traps were used for ions in vacuum media the phenomena of selective charged particles capturing by their dynamic stabilization in alternating electric fields can be used in air at normal environmental conditions. In vacuum charged particle motion is described by the Mathieu equation and areas of particle stable motion is found analytically. In air due to energy dissipation while particle movement through a viscous media the confinement area becomes wider. The phenomenon of charged particle capturing by alternating electric fields in linear Paul trap can be used as a tool for series of applications. It was shown that Paul traps allow for particle capturing not only in stationary gas media but also in gas streams allowing for new technique of selective particle filtering from air streams. Experiments showed the possibility of charged particles filtering from air streams up to 20 cm/s [1].

In alternating electric field particles are captured in certain area of the trap allowing contactless study of particle parameters, such are size, weight and charge by affecting the particle by external constant electric field. Thereby the new method for measuring the charge-to-mass ratio of micron-sized particles, using the linear Paul trap with the end electrode was presented. Experiments were performed for the particle charge acquired by passing through a corona discharge [2].

Varying the parameters of the trap and alternating electric field (its magnitude and frequency), particle charges and their sizes the areas of charged particle confinement can vary allowing for developing new method of spatial contactless charged particle separation. The possibility of particle separation by alternating electric fields has experimentally shown by spatial division of polydisperse powder on two fractions [3].

References

[1] D.S. Lapitsky, V.S. Filinov, L.M. Vasilyak, R.A.Syrovatka, L.V. Deputatova, V.I.Vladimirov, V.Ya.Pecherkin, EPL, 2015, 110, 15001

[2] D.S. Lapitsky, J. Phys.: Conf. Ser., 2016, 666, 012026

[3]D.S. Lapitsky, J. Phys.: Conf. Ser., 2016, 774, 012178