

## O5.301 Dissipative factors effect on the efficiency of the plasma acceleration in electromagnetic accelerator of rail type

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See the full abstract here <http://ocs.ciemat.es/EPS2019ABS/pdf/O5.301.pdf>

The electromagnetic rail accelerators (railguns) with plasma armature are an interesting object for the plasma physics. The acceleration of the plasma (or a solid body ahead of plasma armature) in railguns are due to electromagnetic interaction of the electrical current in plasma and magnetic field (generated by current and from external source). In theory there is no limit on achievable velocity. But in reality there is a velocity ceiling of about 6 km/s. Different dissipative factors are responsible for the limiting of the achievable velocity. In the report the different factors will be analyzed.

One of it is the effect of current leakage through shock-compressed layer. Our experimental and theoretical investigations of the plasma armature motion in a channel of an electromagnetic rail accelerator (railgun) filled with an inert gas will be presented. The model of the plasma armature acceleration takes into account the force of the gas pressure in the shock-compressed layer and the drag force resulting from a capture of a part of the erosive mass by the plasma armature. It is shown that in the case of considerable gas ionization after the shock wave the discharge current flows partly through the conducting shock-compressed layer. This leads to a decrease in the current in the plasma armature, and, hence, in the ampere force. As a consequence, an acceleration crisis occurs and the maximum velocities of the plasma armature becomes limited. Comparison of the experimental and theoretical data on the shock wave velocity in the channel shows that they are in good agreement.

The report will summarize the dissipative factors affecting plasma acceleration and based on the analysis the parameters of achievable plasma jets will be presented. Such application of the railguns can be interesting in terms of construction of new plasma engines for the satellites.

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