

On runaway electrons acceleration in trapped mode during the pulsed discharge and enhancement of plasma generation

Tsventoukh M M

Lebedev Physical Institute of the Russian Academy of Sciences, Leninsky Avenue 53, Moscow 119991, Russia

elley@list.ru

Runaway electrons accelerated in the electric field of a pulsed discharge may substantially change the discharge properties. The existence of this acceleration mechanism is indicated by the x-rays emitted from the discharge and by the increasing propagation velocity of the ionization front. An enhanced non-uniform electric field arises naturally due to the field distortion by the high-density plasma.

A simple model is proposed to describe consistently the electron impact ionization, the electric field enhancement by the space charge of the discharge plasma, and the acceleration of runaway electrons to about 100 eV in the enhanced field. Optimal conditions for acceleration, ionization and field enhancement have been found at the plasma density level $\sim 10^{15} - 10^{16} \text{ cm}^{-3}$ and the energy of hundreds of eV. This energy corresponds to trapped runaway mode of acceleration then the electrons produce maximal ionization instead of continuous acceleration to the anode and x-rays production. Obtained estimations count towards revisiting the role of the runaway electrons in pulsed gas discharge.

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