Filaments and Filamentation of current sheath of plasma focus

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Dynamics and structure of current filaments forming in plasma focus discharge as well as filament number are determined by the atomic composition of the gas filling the interelectrode gap, by the admixtures, by the initial pressure of the gaseous compound and by the electrode shape [1]. The moving current filaments, as a rule, arising near the insulator are the long-lived structurers. Their lifetime may be in order of the discharge lifetime, besides the filaments are stopped near the discharge symmetry axis [2]. As investigations show [3,4] the filaments have an important bearing on intensity of the hard radiations, the particle and plasma fluxes and also on their reproducibility.

Here, the results of current filaments investigations (analytical and numerical) in the plasma model with London current [5,6] are presented. As this takes place, the solutions are rated in order of two main parameters – speed of filament motion (supersonic, subsonic and stationary) and filament radius (less than the London penetration depth or more than the London penetration depth). By the way, independent of a region where a solution is obtained (in any case of the six above regions) the forward discharge current are flowing on the tangential discontinuity surface within the filament structure and the inverse induced currents are around the forward current. The induced currents magnetic field compensates the forward current magnetic field because the plasma with London current is perfect a diamagnetic material.

Besides, at this point the criterion of the optimum current sheath filamentation is proposed an implementation of which will improve a reproducibility of plasma focus radiation features and will increase the radiation intensities. The control method of number filaments in a current sheath by means of special form electrodes utilization including by creating the small-scale periodic inhomogeneities on the electrodes surface near the plasma focus insulator [2] is considered.

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