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# The vacuum-arc plasma motion in a toroidal magnetic field

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The separation of the vacuum-arc plasma from macro-particles in the curvilinear plasma filters allows obtaining coatings with especially high characteristics [1]. However, inside such filters the significant plasma losses also have been occurred. At the same time, increasing in the filter's efficiency is a difficult task without an effective mathematical model that really would describe the vacuum-arc plasma motion in a toroidal magnetic field. The description based on the flax-tube model [2] was in fact only the first approximation in the decision of this problem. According to detailed flax-tube analysis of ions passage through the quarter torus plasma guide, the efficiency of the filter should grow up to 85 % as the positive potential U, applied to the body of the plasma guide, is on the increase [3]. However, the experiment showed that maximum of transparency reach up to ~ 12 %, at potential about of +18 Volts, and comes down under the further increase in potential [4]. Such big digression from experiment does not justify the use of flux-tube model for designing of curvilinear plasma filters.

We offer the new approach to the description of the vacuum-arc plasma motion in a toroidal magnetic field based on the solutions of steady-state ($\partial/\partial t = 0$) Vlasov-Maxwell equations for the long plasma column aligned parallel to a constant axial magnetic field [5]. The relations for the self-consistent electric polarization fields, which appear due to displacement of the electron component from ionic one on the curvilinear part of motion, were derived within a framework of the drift approximation. The dynamics of the central part of the plasma flow in the electric polarization fields was considered in detail. The displacement of the plasma flow at the output of the plasma guide was calculated for the carbon and titanium plasmas. The good agreement with the experimental data was obtained.

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