CALCULATION OF ESCAPE FACTORS FOR ELECTRONS IN NEON AND HELIUM

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An appropriate boundary condition describing electron balance at the cathode surface is of fundamental importance to fluid modeling of gas discharges. This boundary condition is conventionally formulated in terms of the escape factor. Various approaches have been applied to evaluation of escape factors[1]. Recently, escape factors for argon have been obtained by means of Monte Carlo simulation[2] of back-diffusion of electrons to the cathode. Analytical expressions have been derived[3] that allow one to estimate escape factors in atomic plasma under conditions where dominating electron energy losses are due to inelastic collisions electron-atom. The estimates[3] for argon agree with results of Monte Carlo simulations[2], both for non-reflecting and reflecting cathodes, and both for monoenergetic and Maxwellian energy distributions of emitted electrons.

In this work, the results are presented of Monte Carlo simulations of back-diffusion of electrons in neon and helium, performed using the code[2]. The estimates of the escape factors in neon and helium, based on analytical expressions, are also given. It is shown that estimated dependences of the escape factors on the reduced electric field and on the mean energy of emitted electrons agree with those obtained with Monte Carlo simulations. A correction[3], approximately accounting for the effect of reflection of electrons from the cathode surface, gives the values of escape factors for reflecting cathodes being in reasonable agreement with the Monte Carlo data.

1. A.V. Phelps and Z. Lj. Petrović, Plasma Sourc. Sci. Technol. **8**, R21 (1999).
2. M. Radmilović and Z. Lj. Petrović, Eur. Phys. J. AP **11**, 35 (2000).
3. M. S. Benilov and G. V. Naidis, J. Phys. D: Appl. Phys. (submitted).