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Dynamics of ionization fronts during high-pressure gas breakdown. DMITRY NIKANDROV, LEV TSENDIN, St.Petersburg State Polytechnical University, St.Petersburg, Russia, ROBERT ARSLANBEKOV, VLADIMIR KOLOBOV, CFD Research Corporation, Huntsville, AL, USA — Dynamics of gas breakdown is important for numerous high-pressure plasma applications. This paper presents an analytical theory and numerical simulations of the high-pressure gas breakdown. The problem of discharge evolution after applying an external voltage $U(t)$is divided into two sub-problems. The first sub-problem deals with the *proforce* anode front initiated by the electrons present in the gap before the voltage was applied. An analytical solution for the ionization front dynamics is obtained by neglecting electron diffusion and assuming small variation of the electric field compared to the density variation. Expressions for the electron and ion densities, drift velocities, and the electric field are obtained. At the evolution stage, when $U(t)$is decreasing, the formation of an *antiforce* cathode-directed ionization front is possible.The second problem treats the evolution of the *antiforce* (cathode directed) ionization front, which is initiated by the electrons generated upstream with respect to the electron drift. The situation, in which these electrons are emitted from the cathode, is analyzed. When the field perturbation becomes significant, the plasma region is formed, and the plasma boundary moves towards the cathode. The numerical and analytical solutions are in good agreement.

Vladimir Kolobov
CFD Research Corporation

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