

MODELING OF FAST DISCHARGES IN HIGH-PRESSURE GASES

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Pulsed discharges in high-pressure gases are of considerable interest as sources of non-equilibrium plasma for various technological applications: pollution control, pumping of laser media, plasma assisted combustion, etc. Discharge development in gap configurations with non-uniform distributions of electric field, such as point-plane or point-point gaps, typically proceeds via the prebreakdown stage of formation near the stressed electrode and propagation of ionization waves – streamers inside the gap. In conditions when the steepness of applied voltage front is not high, streamers are formed nearly at inception voltages, as thin plasma filaments. The growth of front steepness supplies conditions when streamer formation occurs at strong overvoltages, resulting in generation of wide plasma channels. Such produced plasma structures, similar to glow discharges, are of special interest to applications due to quasi-uniformity of plasma parameters in relatively large gas volumes. The specific features of fast ionization waves, besides large discharge width, are very high propagation velocities, approaching the speed of light and large currents, up to several hundred Amps. In this report, recent results of computational study of fast (subnanosecond) discharge formation are reviewed. On the basis of comparison of simulation results and experimental data the effects of various factors (voltage rise time, polarity, geometry of discharge gap, etc.) on discharge characteristics are revealed. The major physical phenomena governing the properties of fast discharges are analyzed.

Biography

George V Naidis is Principal researcher at the Joint Institute for High Temperatures of the Russian Academy of Sciences. He received his BS degree in Physics from the Moscow State University in 1969, and the CSc (PhD) and Doctor of Science degrees in Plasma Physics and Chemistry from the Joint Institute for High Temperatures in 1977 and 1993, respectively. His research interests include Physical and Chemical Kinetics of Low-Temperature Plasma, Physics Of Gas Discharges, Plasma Medicine. He has published about 130 refereed journal papers and reviews.

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