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Nanosecond-timescale high-pressure gas discharge in a microwave pulse compressor[1] ANATOLI SHLAPAKOVSKI, LEONID BEILIN, YAKOV KRASIK, Physics Department, Technion — The results of experimental and numerical studies of the microwave plasma discharge initiated by a nanosecond laser pulse are presented. The discharge is ignited in the pressurized gas filling the switch, which opens the charged resonant cavity, so that the accumulated microwave energy is rapidly released into a load. Fast-framing optical imaging showed that the plasma in the switch appears as filaments expanding along the RF electric field. The temporal evolution of the plasma density was derived from time-resolved spectroscopic measurements. With increasing microwave energy in the cavity, the plasma appears earlier in time after the laser beam enters the switch and its density rises more steeply reaching values which exceed 10^{16} cm^{-3} at a gas pressure of $2{\cdot}10^5$ Pa. Numerical simulations were conducted using the gas conductivity model of plasma and representation of discharge origin by setting initial population of seed electrons treated by PIC algorithm. The results showed good agreement with the experiments and explained how the self-consistent dynamics of the plasma and RF fields determines the quality of microwave output pulses. In addition, the dynamics of the microwave energy absorption in the discharge plasma was studied. It was shown that at a high pressure, even with an unlimited rate of ionization, a significant portion of the stored energy, $\approx$20%, is lost.

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