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Periodic pulse discharge self-focusing and streamer-to-spark transition in under-critical electric field ANDREY STARIKOVSKIY, ALEKSANDR RAKITIN, SERGEY PANCHESHNYI, DREXEL UNIVERSITY TEAM, NEQLAB RESEARCH BV TEAM, UNIVERSITY OF TOULOUSE, LAPLACE TEAM — Repetitive pulsed nanosecond discharge was investigated for point-to-plate geometry. The sequence of electrical pulses has been investigated one-by-one. The measurements were performed with the help of 4Picos ICCD camera with camera gate 1 ns. The discharge starts at the high voltage electrode, and after about 4 ns, the streamer channel bridges the discharge gap. The return stroke leads to redistribution of the potential along the gap. The reduced electric field in the plasma channel becomes lower than the breakdown field (about 120 Td for room-temperature air), and slow plasma recombination begins. Plasma recombination does not affect the discharge current and gas excitation during the pulse ($\sim$ 10 ns). At this time, the plasma channel becomes invisible. Next pulses lead to streamer propagation through the pre-excited media. Streamer channel diameter decrease (self-focusing) was observed for pulses 2-4. Gas heating leads to the density decrease and increase of reduced electric field. Transition to spark was observed in next pulses. Discharge energy increases from 2 to 25 mJ/pulse for pulses 1 to 10.

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