

Pre-breakdown flow in distilled water under the influence of microsecond voltage pulses

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Using the Particle Image Velocimetry (PIV) method with high spatial and temporal resolutions, the formation and evolution of flow in water with a conductivity of $5\ \mu\text{S}/\text{cm}$ near an electrode under the action of a voltage pulse of microsecond duration was studied. The movement of water at early times after the pulse is applied (from $2\ \mu\text{s}$) occurs from the surface of the needle. A thin jet at the edge of the cylinder, directed diagonally from the surface, appears at about $64\ \mu\text{s}$. The involvement of liquid from under the end leads to a reversal of the flow and the formation of one of several vortices accompanying the jet. The simulation results are consistent with the observed flow pattern and allow us to draw conclusions about the distribution of the force acting from the electric field and the resulting pressure in the fluid. The presence of a region in which the force vector changes direction leads to a displacement of the jet from its original direction towards the end. The calculated dimensions and position of the vortex coincide with reasonable accuracy with those recorded in the experiment.

Keywords: flooded jet, plasma torch, flow around a rod, erosion, diagnostics.

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