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Development and Applications of discharges generated in liquids with short high voltage pulses JUERGEN KOLB, CAMELIA MIRON, ANGELA KRUTH, Leibniz Institute for Plasma Science and Technology, MICHAL BALCERAK, MICHAL BONISLAWSKI, MARCIN HOLUB, West Pomeranian University of Technology — Discharges that are generated within a liquid have been of scientific interest for more than a century. The possibility for a breakdown development that is not mediated by an initial gaseous phase is still disputed. In this respect are especially discharges that are instigated with short high voltage pulses calling for attention. Associated with this specific excitation scheme is a change in plasma development, plasma parameters and reaction mechanisms in the liquid. We have compared discharges in a point-to-plane geometry that were generated with 50-us or 10-ns high voltage pulses. Time-resolved shadowgraphy and spectroscopy were performed to evaluate discharge structures, plasma parameter and reactive species that were formed in distilled water or ethanol. Different propagation modes, with velocities of 6.7 km/s for tree-like streamers and only 50 m/s for bush-like streamers, were observed. Optical emission spectroscopy has shown the formation of molecular bands of nitrogen, as well as strongly broadened atomic hydrogen and oxygen, which are likely to be responsible for the observed surface modifications of polymers. With nanosecond high voltage pulses we found an increase of unsaturated bondings for polyimide surfaces that were exposed in the discharge volume.

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