PULSED AND SELF ELECTRICAL BREAKDOWN IN BIODEGRADABLE OIL

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The fundamental breakdown physics of biodegradable oil is investigated with high speed electrical and optical diagnostics with temporal resolution down to several 100 ps. The set up employs a cable discharge into a coaxial system with axial discharge and load line to simulate a matched terminating impedance. A unique feed-through design creates no discontinuities in the system lines through the discharge chamber. The impedance of the system is matched at 50 ohms including a novel design for impedance matching transitions from discharge cable to coaxial system to load line allowing for a sub-nanosecond response. Final results are measured on pulsed and self breakdown voltages of up to 200 kV. Self breakdown is achieved by charging the discharge cable and load line to +/-100 kV respectively. Pulsed breakdown is achieved by charging the discharge cable and load line to +100 kV. Shorting the discharge cable generates a reflected negatively polarized pulse causing breakdown. Transmission line type current sensors and a capacitive voltage divider with fast amplifiers/attenuators are used in order to attain a complete range of information from amplitudes of 0.1 mA to 1kA with temporal resolutions of 300 ps. Optical measurements are performed on low level light emission using fast photo-multiplier tubes (risetime of 800 ps) spatially resolved, supplemented with high speed photography and spectroscopic investigations on a nanosecond timescale. Detailed optical and spectroscopic diagnostic along with high speed electrical diagnostics will address mechanism initiating/assisting the biodegradable oil volume breakdown.

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