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Liquid Dielectric Breakdown Studies using Compact Tesla Pulse Generator

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Liquid dielectric breakdown properties are studied towards the development of efficient intermediate storage devices for pulsed power applications. A Tesla based pulse generator along with suitable voltage (V-dot) and current (self-integrating Rogowski coil) sensors are indigenously developed. The experiments are performed by applying few 100 KV with few tens of nanosecond pulse under uniform electric field conditions. Preliminary experiments are carried out on deionized water ($\varepsilon r = 78$, $\sigma < 1$ μS/cm), the experimental parameters being different electrode materials (brass and stainless steel), inter electrode gaps (3, 6, 8 mm) and applied polarity (positive and negative). Subsequently, the experiments are extended to understand the suitability of heavy water for compact pulsed power applications. In addition to the electrical diagnostics, optical measurements i.e. absorption spectroscopy and emission spectroscopy are also used for understating the breakdown properties. Further, the discharge initiation and evolution is studied using a fast camera (4 PICOS ICCD). The observations indicate significant charge holding capability in case of stainless steel compared to brass, suitability of water in comparison to heavy water for compact pulsed power applications. The experimental details and important outcomes will be presented.

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