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Dielectric Breakdown of Vaporized Organic Carbonates

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Lithium-ion batteries are being more widely utilized as the prime power source of rep-rate pulsed power systems. Battery open circuit potentials as high as 1 kV have been proposed for use in naval shipboard power architectures. While this potential may not seem that high to engineers within the pulsed power and/or high-voltage power system communities, it is significant and must be designed with caution, especially when field enhancements are present that could significantly multiply the applied electric field. The amount of energy stored in a shipboard battery could exceed a few GJ in some instances making it critical that any potential electrical breakdown weaknesses be identified and studied in detail. Though it is likely easy to engineer the battery such that dielectric clearances well exceed any 1 kV potential in a normal operating conditions, it is unclear how failure of a cell, and the leakage of electrolyte gas from a sealed cell(s), may affect the surrounding environment and the dielectric strength between high voltage electrodes separated by air. Reduction in the dielectric strength could result in a cascading effect whereby more cells are allowed to fail. The dielectric strength of vented electrolyte gas has not been previously documented and it is the aim of this work to fill this knowledge gap.

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