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Measurement and analysis of luminescence signal and emission spectrum in vacuum surface flashover for polymeric materials

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Surface flashover of insulators in vacuum has been investigated for decades, the most widely accepted mechanism for the process is secondary electron emission avalanche (SEEA) and the gases generated from surface discharge play a crucial role. In this paper, the flashover was excited by a microsecond single pulsed generator with a rise time of 500 ns and a full width at half maximum of 8 μs. The gap between the finger electrodes is 1 mm. Optical diagnostic methods were adopt to investigate the luminous properties of polytetrafluoroethylene (PTFE), polymethylmethacrylate (PMMA) and polyamide (PA6). Time evolution of luminescene signal was measured by PMT with wavelength range from 300 nm to 650 nm. The emission light spectrum was also measured to detect the gases generated from surface discharge. The results show that the luminescence signal appears approximately 300 ns before flashover, and flashover occurs approximately 80 ns before light intensity sharply increases. The luminescence signal was also measured when flashover didn't occur in the lower applied voltage. The result shows that the luminescence signal intensity is weakened with increase of applied pulsed numbers. The emission light spectrum is mainly in range of 400-800 nm, and the C2 peak is distinctly detected in three materials, indicating that the carbon chain of polymeric materials is broken when flashover occurs. H2 and F peaks are also detected in PTFE, and H peak in PMMA and PA6. These may come from the desorption gases or decomposition products in the course of surface flashover.

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