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Experimental study of breakdown in low-pressure argon between parabolic electrodes ERIK WAGENAARS, NIELS PERRIËNS, GERRIT KROESEN, Eindhoven University of Technology, The Netherlands, MARK BOWDEN, The Open University, United Kingdom — Plasma breakdown phenomena in low-pressure argon gas were investigated by making time-resolved images of the plasma light emission, using an intensified charge coupled device (ICCD) camera. The breakdown arrangement consisted of 2 electrodes mounted inside a vacuum chamber creating a 3.3 mm discharge gap. A flow of argon gas was directed through the system, while a needle valve maintained the pressure at 465 Pa (3.5 torr). The electrodes were cylindrically symmetric and had a parabolic cross section. A repetitive, quasi-dc breakdown was created by applying voltage pulses with an amplitude of about 350 V, a duration of 100 μs and a repetition rate between 10 and 2000 Hz. Our measurements show a general breakdown behavior consistent with the Townsend breakdown theory. Additionally, we observed the appearance of a light flash near the anode at a time when the applied voltage was below the static breakdown voltage. This phenomenon could not be explained by Townsend theory and was investigated further by varying the rise time, repetition rate, polarity and shape of the applied voltage pulses. It was concluded that this feature was the result of charges close to the discharge volume, left over from the previous discharge cycle. These charges created weak electron avalanches at low applied voltages, before the main breakdown phase started.

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