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Spectral Measurements of Low Temperature Plasma Formation at Atmospheric Pressure[1] GEORGE LAITY, ANDREW FIERRO, DAVID RYBERG, LYNN HATFIELD, ANDREAS NEUBER, TTU Center for Pulsed Power and Power Electronics — This paper describes the study of the emission and reabsorption of ultraviolet (UV) and vacuum ultraviolet (VUV) radiation which is produced during the initial phases of plasma formation leading to electric field breakdown at atmospheric pressures. Specifically, there is interest in understanding the photon dynamics during the streamer to spark phase transition of plasma discharges which form less than 200 ns in millimeter-sized air gaps. Fast rise-time photo-multiplier measurements reveal that the earliest VUV emission occurs in the region near the anode, with emission points following streamer positions identified by fast intensified CCD imaging with fast electronic gating (<3 ns). Electron densities and dissociation characteristics are estimated by using measurements of the HI Lyman-α (121.5 nm) Stark-broadened line profile as a function of distance from the anode. Successive measurements in pure N2 environments show a distinct two-step transition from radiative contributions of both the N2 second positive system in the UV (300 - 400 nm) and NI atomic structure in the VUV (120 - 180 nm) during the early plasma phase, to primarily VUV emission shortly after the plasma spark has formed. The observed emission dynamics are due to a combination of N2 dissociation into NI and radiation-less quenching of the N2 molecules.

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