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Breakdown Phase of Pulsed N_2/He Atmospheric-pressure Micro-hollow Cathode Discharge Plasma TOSHIKI NAKANO, SHINYA WAKE, TAKESHI KITAJIMA, National Defense Academy — The breakdown phase of a pulsed N_2/He atmospheric-pressure micro-hollow cathode discharge plasma is studied by temporally resolved N_2 optical emission spectra as well as the waveforms of discharge current and voltage. The simultaneous measurements of N_2 emission and current in the pulsed plasma reveal the appearance of the current pulses which coincide with N_2 emission in the breakdown phase. N_2 emission intensity exhibits a sharp peak in the breakdown phase and becomes constant in the glow-discharge phase. Temporal variation of N_2 emission spectra indicates that N_2 rotational temperature remains below 500 K immediately after discharge ignition but rises promptly to 1000 K within 20 μs after the ignition. The average N_2 emission intensity during a current pulse in the breakdown phase is 3 orders of magnitude higher than that in the glow-discharge phase whereas the energy required for N_2 emission is lower by a factor of 60 during the current pulse than in the glow-discharge phase. Thus, in the breakdown phase, the plasma with high excitation and dissociation rates is likely to be generated efficiently even though neutral temperature remains low.

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