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Optical emission spectroscopy of nanosecond repetitively pulsed microplasmas generated in air at atmospheric pressure THOMAS ORRIERE, ERIC MOREAU, NICOLAS BENARD, DAVID PAI, Institut PPRIME — Nanosecond repetitively pulsed (NRP) microplasmas are generated in room temperature air at atmospheric pressure, in order to investigate the enhanced control of discharge properties via the combined effects of spatial confinement and nanosecond repetitive pulsing. Discharges were generated using high-voltage pulses of 15-ns duration applied to a tungsten pin-to-pin reactor, with inter-electrode gap distances (d) from 2 mm down to 0.2 mm. Optical emission spectroscopy and electrical characterization performed on the discharge indicate that heat transfer and plasma chemistry are influenced by the microplasma geometry. Ultrafast gas heating is observed upon deducing the rotational temperature of N_2 from the measured emission spectrum of the N_2 (C→B) (0, 2) and (1, 3) transition bands, but use of the microplasma geometry (d = 0.2 mm) results in lower gas temperatures than in larger discharge gaps (d = 2 mm), including at high pulse repetition frequency (30 kHz) where substantial steady-state gas heating can occur. The measured Stark broadening of the H_α transition is significantly greater than for previously studied NRP discharges in air at atmospheric pressure, indicating that the maximum electron number density may be correspondingly much greater, up to 10^{18} cm^{-3}. Furthermore, for NRP microplasmas, the intensities of emission from excited atomic ions (O^+ and N^+) are much higher than those of excited neutral atoms (O and N), in contrast to NRP discharges generated in larger discharge gaps.

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