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Temporal evolution of OH density and gas temperature of nanosecond repetitively pulsed discharges in water vapor at atmospheric pressure FLORENT SAINCT, DEANNA LACOSTE, CHRISTOPHE LAUX, Ecole Centrale Paris, EM2C Laboratory, France, MICHAEL J. KIRKPATRICK, EMMANUEL ODIC, Supelec, France — We present a study of plasma discharges produced by nanosecond repetitively pulses in water vapor at 450 K and 1 atm. The plasma was generated in water vapor with 20-ns duration high-voltage (0-20 kV) pulses, at a repetition frequency of 10 kHz, in the spark regime (2 mJ/pulse). To investigate plasma kinetics we focused on intermediate products of the discharge, in particular the hydroxyl radical. Between two discharges, the time-resolved density of OH was measured by Planar Laser Induced Fluorescence (OH-PLIF). The temperature during the discharge was determined by optical emission spectroscopy, and between two pulses by two-color OH-PLIF. A 150 K preheating effect from the previous pulses is measured, with a maximum temperature elevation of 950 K during the first 10 μs following each pulse. The OH density measurements were compared with chemical kinetics simulations. The numerical results obtained with an initial OH density of 500 ppm show good agreement with the experimental data, thus providing a quantification of the OH density produced by the pulse. The electron number density is also measured via stark broadened H_β lines. A kinetics model is proposed to interpret the measures.

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