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Nanosecond Glow and Spark Discharges in Ambient Air and in Water Vapor[1] CHRISTOPHE LAUX, DIANE RUSTERHOLTZ, FLORENT SAINCT, DA XU, DEANNA LACOSTE, GABI STANCU, EM2C Laboratory, CNRS - Ecole Centrale Paris, DAVID PAI, PPRIME Institute (CNRS - University of Poitiers - ENSMA) — Nanosecond repetitively pulsed (NRP) discharges are one of the most energy efficient ways to produce active species in atmospheric pressure gases. In both air and water vapor, three discharge regimes can be obtained: 1) corona, with light emission just around the anode, 2) glow, corresponding to a diffuse nonequilibrium plasma, and 3) spark, characterized by higher temperatures and higher active species densities. The glow regime was initially obtained in air preheated at 2000 K. Based on a model defining the transition between glow and spark, we recently succeeded in obtaining a stable glow in ambient air at 300 K, using a judicious combination of electrode geometry, pulse duration, pulse frequency, and applied voltage. We will present these results and describe the characteristics of the discharge obtained in room air. The spark regime was also studied. NRP sparks induce ultrafast gas heating (about 1000 K in 20 ns) and high oxygen dissociation (up to 50% dissociation of O_2). This phenomenon can be explained by a two-step process involving the excitation of molecular nitrogen followed by exothermic dissociative quenching of molecular oxygen. The characteristics of NRP discharges in water vapor will also be discussed.

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