Abstract Submitted
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Student Excellence Award Finalist: The Ionization Mechanism of Thermal Sparks[1] NICOLAS MINESI, PIERRE MARIOTTO, GABI-DANIEL STANCU, CHRISTOPHE LAUX, Laboratoire EM2C, CentraleSupelec, CNRS, Universite Paris-Saclay — Recent experimental studies demonstrated that nanosecond discharges can produce fully ionized plasmas via the so-called thermal spark. In room air, it was shown that the plasma can reach full ionization within a few nanoseconds, and that the gas temperature can increase above 40,000 K. In this work, experimental and numerical approaches are used to investigate this fast ionization. The electron number density is measured using the Stark broadening of the H_α line. The lineshape fitting of the N^+ and O^+ lines between 480 and 520 nm provides (i) the electron temperature, assumed equal to the gas temperature, and (ii) a second measurement of the electron number density by Stark broadening. A third measurement of the electron number density is given by the continuum radiation of electrons. These measurements are compared to the output of a 0-D numerical simulation performed using ZDPlasKin and BOLSIG+. The originality of the kinetic model is to consider not only the excited electronic states of N_2, but also the excited electronic states of O and N. We show that the experimental and numerical results agree only if the ionization of excited states of O and N are included in the simulations.

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