Comprehensive determination of the ionization composition of pulsed erosive discharge plasma in a polymer material capillary

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In this work we study a high-enthalpy supersonic plasma jet which is created by a pulsed discharge in polymer capillary due to variation of erosion decomposition rate of capillary wall and graphite electrode with adjustable ratio of main components of a polymer C_m:H_n. Our setup allowed to register a 2D spectrum which is spatially resolved along plasma radius with exposition of 10–30 μs at a given moment of impulse evolution of 1 ms duration. The discharge was created in air medium at atmospheric pressure. By studying a set of spectra obtained from discharges with controlled increase of specific energy input we established that graphite anode decomposition was increasing causing a radical change in the initial ratio of C:H = 1:2 at the capillary exit which is close to stoichiometric. We determined temperature profiles of $T_e(r)$ using chord distributions of C II 426.7 and C III 418.7 nm line intensities [1]. The electron concentration $n_e(r)$ required for that could be determined independently from C II 426.7 nm line contour width due to significant value of its Stark broadening constant [2]. As a result of an increase in energy input, the plasma undergoes a rapid increase in the n_e concentration from 3.0×10^{17} to 2.0×10^{18} cm^{-3} with the main ionization contributor being the double C^{++} ion.

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[2] Konjevic N and Wiese W L 1990 *J. Phys. Chem. Ref. Data* **19** 1307–1385