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Diagnostics of plasma jet and dielectric barrier discharge plasma parameters by optical emission spectroscopy

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The plasma jet and dielectric barrier discharge plasma, non-thermal plasma type at atmospheric pressure, has drawn significant interest as a study subject across numerous scientific fields. Examples include material processing, nanotechnology, pollution control, atmospheric pressure plasma jets, surface modification of polymers for biological applications (medicine, healthcare, and plasma biology), and pollution control[1,2,3,4,5,6]. At gas flow rates between 1 and 5 liters per minute, this research abstract offers an experimental approach for determining the plasma properties in the jet plasma and dielectric barrier discharge plasma systems with molecular and atomic gas sources (Nitrogen, Oxygen, Argon, Helium and mixed gases) at varied voltage and standard atmospheric pressure[7]. This method is based on OES, or optical emission spectroscopy[8]. In emission spectroscopy, each spectral line represents an optical transition between the quantum states of two atoms or molecules. The concentrations of species in different higher stages determine the intensity of the spectral lines[8,9]. In low-pressure discharge systems, we calculated the electron density (ne) and electron temperature (Te) using ratios of line intensity and the Boltzmann equation[7]. Additionally, measurements were taken of the electron temperature and plasma properties linked to electron density, like (λ_D, N_D, and ωp)[7,8,10]. The plasma was created using a variety of flow rates. The Debye length, plasma frequency, and particle number on the Debye surface are all strongly impacted by an increase in gas flow rate on the plasma characteristics, and they all rise with the gas flow rate.

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