Quantification Approach of Gas Temperature Distribution in Atmospheric Positive DC Glow Discharge Measured by Spectroscopic Imaging

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In our previous work, a two-dimensional (2D) gas temperature distribution in a positive DC steady-state glow corona was qualitatively measured by spectroscopic imaging. Spectral images of its glow corona were taken using ICCD camera with ultra-narrow band-pass filters, and they were corresponded to the head and tail of a second positive system bands of nitrogen (2PS N\textsubscript{2} (0-2)). The qualitative gas temperature was obtained from the emission intensity ratio ($I_{2P\text{tail}}/I_{2P\text{head}}$) between the head and tail of 2PS N\textsubscript{2} (0-2). This emission intensity ratio also equals the rotational temperature ($T_R$), and $T_R$ almost equals the gas temperature ($T_G$) in atmospheric pressure. In this work, the qualitative 2D gas temperature distribution was derived from 2D $I_{2P\text{tail}}/I_{2P\text{head}}$ plots, and the calibration date of $I_{2P\text{tail}}/I_{2P\text{head}}$ for $T_R$ was accumulated by investigating the relationship between the spatially average absolute gas temperature ($T_{av}$) obtained by single-point spectroscopic measurement and the average value of $I_{2P\text{tail}}/I_{2P\text{head}}$ plots. On the basis of the calibration date, a spectroscopically-imaged qualitative 2D $I_{2P\text{tail}}/I_{2P\text{head}}$ distribution in a positive DC glow corona was converted to a quantitative 2D image of gas rotational temperature.

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