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ELECTRIC FIELD MEASUREMENTS IN A NANOSECOND PULSED ATMOSPHERIC PRESSURE PLASMA JET IN HELIUM

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We report on the spatial and temporal distribution of electric field strength in a nanosecond atmospheric pressure helium plasma jet during the evolution of the discharge when impinging on an ITO glass substrate. We used a non-invasive optical spectroscopy technique based on polarization-dependent stark splitting and shifting of the He I at 492.19 nm ($2p\ ^1P^0 - 4d\ ^1D$) line and its forbidden ($2p\ ^1P^0 - 4f\ ^1F$) counterpart. The wavelength separation between allowed and forbidden lines is dependent on the electric field strength due to the Stark effect. For the He I at 492.19 nm, the separation between allowed and forbidden components can be written as a third order polynomial function of the electric field[1]. The electric field is deduced from the experimentally measured separation. For our experimental conditions, the peak electric field value was measured to be ⊠ 15 kV/cm at the streamer head and it reduces to ⊠ 9 kV/cm at the streamer tail.
The results show strong interference of N_2 second positive system emission (v = 1-7) in the low E-field regions and also the presence of a field free component in the He I line in spite of the time resolved measurements on a time scale of 4 ns. The impact of these factors on the accuracy of the technique and the possibility to measure surface electric fields is also discussed.

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1.M. M. Kuraica and N. Konjević, "Electric field measurement in the cathode fall region of a glow discharge in helium", Applied Physics Letters, June 4, 1997, pp. 1521-1523.

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