

# MEASUREMENT OF THE ELECTRON DENSITY USING $H_{\alpha}$ SPECTRAL LINE BROADENING IN A COLD ATMOSPHERIC PRESSURE ARGON PLASMA JET

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Cold atmospheric pressure plasma jets are in particular interest due to the production of reactive species (e.g. O, O<sub>3</sub>, OH, N, N<sub>2</sub><sup>\*</sup>) used in numerous plasma-aided applications. The plasma reactions used in those application are determined by the environmental and physical characteristics. One of the main plasma parameters is electron density and for theoretical models simulating discharge plasma chemistry its accurate values are needed. There are many diagnostic methods to estimate electron density, including optical emission spectroscopy (OES), Thomson scattering and Langmuir probe. In case of OES, it can be modeled from  $H_{\alpha}$  spectral line due to a strong Stark broadening which is dependent on electron density. The

aim of the present study is to estimate electron densities for a cold atmospheric pressure argon plasma jet using the latter method.  $H_{\alpha}$  line shape was measured using a spectrometer (MDR-23) and fitted with a theoretical Voigt shape. Stark broadening was estimated subtracting other line broadening mechanism such as Doppler broadening and Van der Waals broadening. Electron densities were estimated in

different positions of the discharge and also

in three different environments: air, nitrogen and oxygen (Fig.1). Independent of used environments the highest electron densities were recorded near the plasma tube orifice. This phenomena could be explained with increased electric field value in this region [1].

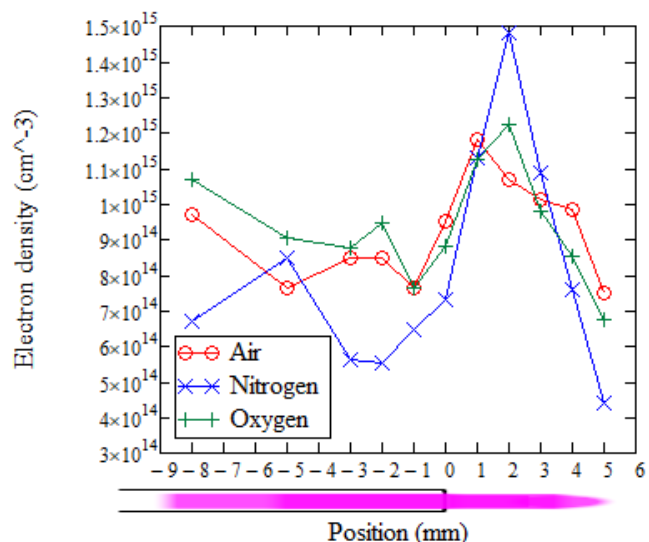


Fig.1 Electron density dependence of measurement position in different environments.

## References

1. Jánký J, Bourdon A (2011) *Simulation of helium discharge ignition and dynamics in thin tubes at atmospheric pressure*. Appl Phys Lett 99:161502–161505.