# Detection of ozone in an atmospheric pressure plasma jet

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Ozone detection in the effluent of an atmospheric pressure plasma jet was performed using two different techniques, namely UV absorption spectroscopy in the Hartley band and quantum cascade laser absorption spectroscopy in the mid-infrared spectral region.

## 1. Introduction

Due to the progress in recent years in the development and research of non-equilibrium atmospheric pressure plasmas with high reactive species densities at low gas temperature, plasma treatment of sensitive surfaces has become possible. Most importantly the possibility of treating living tissue promises frontier breaking therapeutic approaches in the new field of plasma medicine [1, 2]. For a thorough analysis of the interaction of cold plasmas with sensitive biological materials, a detailed quantitative analysis of the reactive component output is required. A prominent reactive molecule that is generated by the plasma is ozone. Since this molecule is biological active and long living it can play a significant role in plasma-cell interaction.

## 2. Ozone detection methods

In order to determine the ozone density in the effluent of an atmospheric pressure argon plasma jet (kinpen, neoplas GmbH, Germany) with small oxygen admixture (0 - 2%) UV absorption spectroscopy in the Hartley band as well as quantum cascade laser absorption spectroscopy in the mid-infrared spectral region is performed [3]. UV absorption spectroscopy can determine space resolved ozone concentrations, while quantum cascade laser absorption spectroscopy has a high sensitivity and determines the spatially averaged ozone output of the jet with high accuracy, so that even the ozone generation from ambient air oxygen diffusing into the plasma jets effluent at zero oxygen admixture to the feed gas can be quantified.

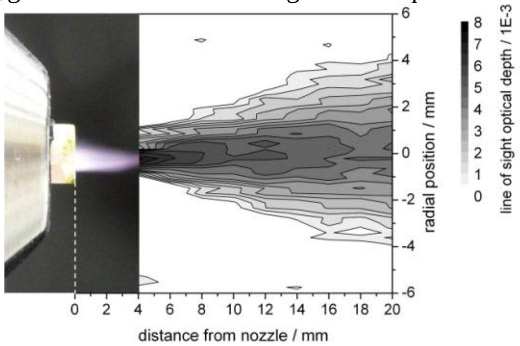


Fig. 1: *Spatial line of sight optical depth of ozone in the vicinity of the jet effluent resulting from the UV-absorption measurement.*

From the UV absorption spectroscopy measurements a two dimensional map of the optical depth of the ozone absorption is recorded (Fig. 1), from which a map of the ozone distribution is calculated via Abel transformation. The IR absorption measurements were performed in a white-cell with an absorption length of up to 16 m. Hence, the density measured with this IR absorption technique does not give space resolved ozone distribution but the averaged density in the cell. However, in order to compare both the ozone detection method in the UV spectral range and the IR absorption measurements the ozone production rate is calculated in both cases. The result is presented in Fig.2. In dependence on the oxygen admixture an increasing ozone production rate was obtained. Furthermore, excellent agreement was found in comparing both ozone detection methods.

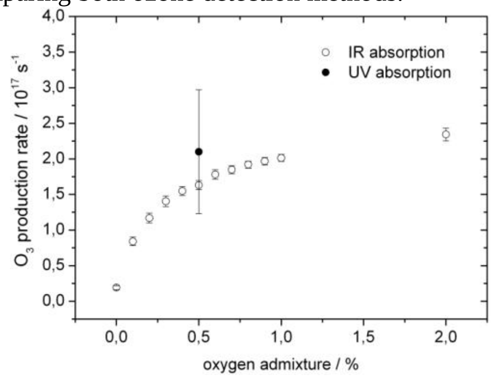


Fig. 1: *Ozone production rate of the investigated plasma jet in dependence on oxygen admixture determined with the IR-absorption technique (open circles) and UV-absorption technique (full circle).*

## References

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