Influence of modulation regimes on longitudinal distribution of active species in atmospheric pressure plasma jet

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1. Introduction

Nowadays, atmospheric pressure plasma jets are used in variety of industrial applications [1]. The jets can operate in broad range of operating parameters that can be adjusted to achieve the best performance for desired outcome. As the plasma is blown out of a discharge tube, it reacts with surrounding atmosphere. Consequently, the plasma properties differ significantly along the plasma flame axis with pronounced effects for e.g. plasma surface treatment.

Modulating the microwave power can be interesting tuning parameter. Using optical emission spectroscopy (OES) we carried out the spatially resolved diagnostics of microwave plasma jet with focus on various plasma species.

2. Experimental setup

Schematic drawing of the experimental setup is shown in Fig. 1. As a plasma source, surfatron [2] was used. For the generation of plasma, surfatron uses a surface wave propagating along the interface between plasma and dielectric tube wall. As for other discharges with surface wave, also the surfatron plasma exhibits typical elongated plasma form with slow decrease of plasma density towards the discharge end. Power was supplied by microwave (2.45 GHz) generator, either in continuous wave (CW) or amplitude modulated (AM) mode. We worked with argon as working gas, without any intentional admixtures, except for admixtures coming from surrounding air at the open end of the discharge tube.

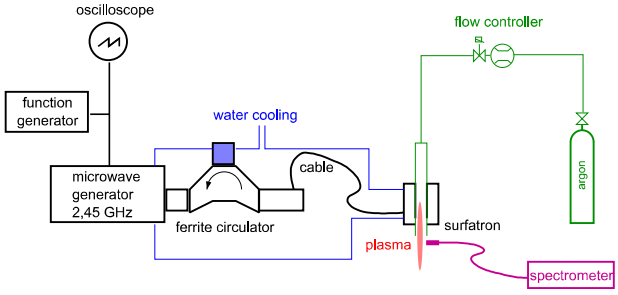

Fig. 1: *Schematic drawing of the experimental setup.*

3. Results

We plotted the relative intensities of four most essential spectral ranges [3] along the axis of the luminous flame and plasma afterglow. As can be seen in Fig. 2, argon line intensity outside the tube decreases continuously. All the admixtures from air (OH, N_2, O) have a common maximum that in CW mode coincides with the position of flame end. In AM mode, the maximum intensity is observed at approximately the same position, although the visible flame in this mode is longer. Also, the maximum in CW mode is sharper. In the afterglow, admixtures from air dominate the spectrum over argon lines.

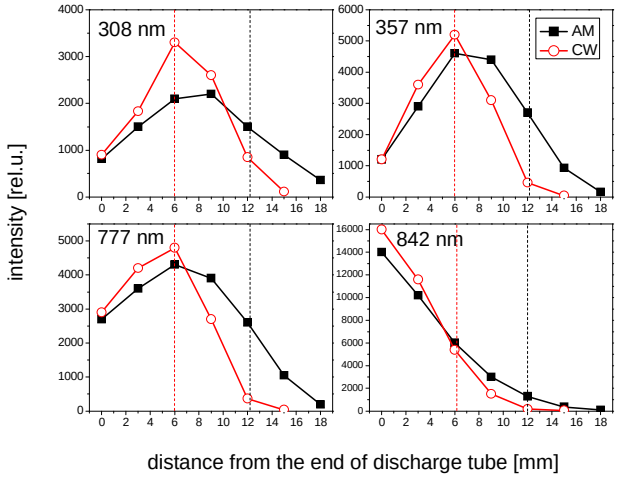

Fig. 2: *Relative intensity of spectral lines and band for OH, 2nd positive system of N_2, atomic O and Ar in AM and CW mode. Vertical lines indicate the apparent plasma flame end (AM - 12mm, CW - 6mm).*

Acknowledgement

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References

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