Abstract—We present nitrogen microwave blown-out plasma at atmospheric pressure and its emission spectra with their spatial distribution. The plasma had a symmetric conical shape until it collapsed to a funnel-like shape at high gas flow rates. We observed the emission of N\textsubscript{2}, N\textsubscript{2}\textsuperscript{+}, CN and NO: their Abel-inverted emissivity increased with increasing power and decreased with plasma radius.

Index Terms—Atmospheric pressure, microwave plasma, nitrogen, optical emission spectroscopy.

Atmospheric pressure microwave (MW) plasmas present considerable interest for a wide range of applications, such as air pollution control, surface treatment, or plasma synthesis. In this paper, we present the brief photographic and spectroscopic characteristics of atmospheric nitrogen MW torch plasma. We used a Litmas Red MW plasma torch (2.45 GHz, 3 kW) to generate atmospheric nitrogen plasma with temperatures 3000 K–4000 K. Contrary to the typical MW torch systems [1], gas in this paper was tangentially injected with temperatures 3000 K–4000 K. Contrary to the typical MW graphic and spectroscopic characteristics of atmospheric nitro-plasma synthesis. In this paper, we present the brief photocations, such as air pollution control, surface treatment, or uniba.sk).

EAP.RIG 981194. MVTS NATO981194; APVV 0267-06 and VMSP-P-0037-07; and NATO work was supported by the Slovak Grants VEGA 1/2013/05 and 1/3043/06; W and D lamps. Radial emissivity profiles in absolute units because the optical system was calibrated with radiation standards: W and D lamps. Radial emissivity profiles of N\textsubscript{2}, N\textsubscript{2}\textsuperscript{+} and CN were radially symmetric and showed that the emissivity decreased with increasing r and h, except for the NO γ profile that was not symmetric, as shown in Fig. 3. We expected the strongest NO emission at the plasma edges, where heated nitrogen reacts with O\textsubscript{2} in the surrounding air and forms NO. However, we found the maximum emissivity in a certain r and not at the plasma edge. This is possibly because the plasma was spiral-twisted and entrained the surrounding air. It would also explain why the emissivity maximum was not found at the same radius for various heights.

These investigations revealed some basic tenets of physics and the spatial distribution of active species in the nitrogen atmospheric MW blown-out plasma that can be used for many applications.

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Fig. 1. Plasma photographs (a) at varying $P$ with constant $Q = 15$ l/min (aperture 22, exposure time 2 s), and (b) a collapse of the plasma cone at higher gas flow rates ($P = 1.78$ kW, aperture 22, exposure time 1 s).

Fig. 2. Typical UV line-integrated emission spectrum of generated nitrogen MW plasma ($P = 1.46$ kW, $Q = 15$ l/min).

Fig. 3. Asymmetric Abel-inverted radial profiles of NO $\gamma$ plasma emission in various heights ($P = 1.46$ kW, $Q = 15$ l/min).

REFERENCES

