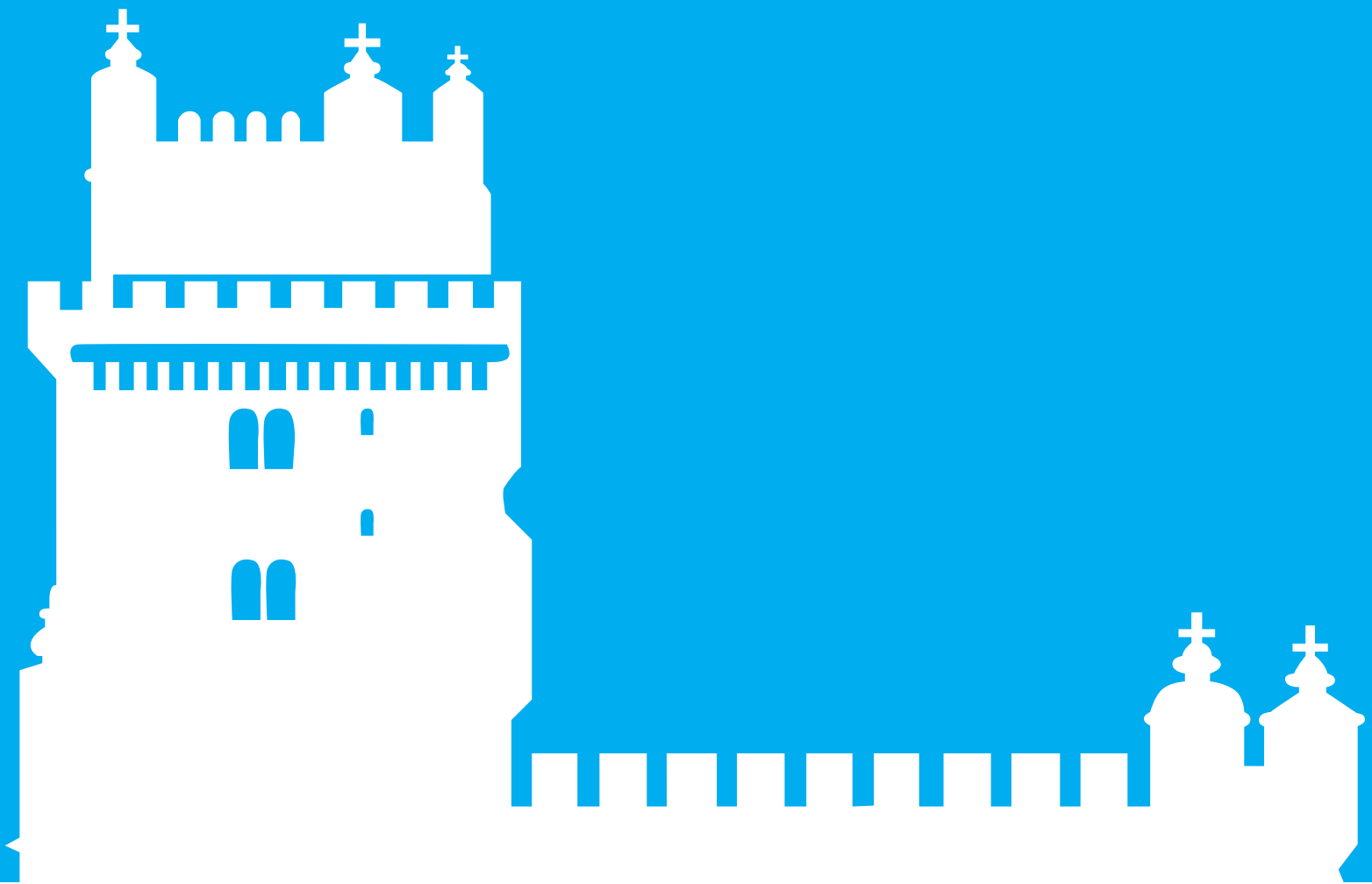
ICPIG 2017

XXXIII INTERNATIONAL CONFERENCE ON PHENOMENA IN IONIZED GASES

CONFERENCE PROCEEDINGS



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Luís Lemos Alves
Antonio Tejero-del-Caz

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Antonio Tejero-del-Caz
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The XXXIII ICPIG was organized in accordance with IUPAP principles, regarding the free circulation of scientists for international collaborations and discussions, as stated in the declaration of the International Council of Science, adopted at the 26th General Assembly in 2008 and endorsed by the 27th General Assembly in 2011. In particular, no *bona fide* scientist is excluded from participation on grounds of origin, nationality or political considerations unrelated to science.

Comparative cross-correlation spectroscopy study of positive and negative polarity transient spark discharge in ambient air

M. Janda[1], A. Sarani[2], T. Hoder[3], T. Gerling[2], R. Brandenburg[2], Z. Machala[1]

[1] *Faculty of Mathematics, Physics and Informatics, Comenius University in Bratislava, Slovakia*
[2] *INP Greifswald e.V., Greifswald, Germany*
[3] *Faculty of Science, Masaryk University, Brno, Czech Republic*

A streamer-to-spark transition in a self-pulsing transient spark (TS) discharge of positive and negative polarity in air was investigated using cross-correlation spectroscopy. The temporal evolution of the TS was recorded for several spectral bands and lines. The results enable the visualization of the different phases of discharge development. In positive polarity, we observed the primary and the secondary streamer, both propagating from the needle anode towards the plane cathode. In the negative polarity, the primary streamer propagating from the needle cathode was followed by the backward propagating streamer. The transition to the spark was not recorded due to relatively long (0.3-1.5 μs) and irregular streamer-to-spark transition phase.

1. Introduction

The transient spark (TS) is a dc-operated, self-pulsing filamentary discharge [1]. We optically explore the evolution of TS in ambient air in needle-to-plane geometry at mean pulse repetition rate ~2-3 kHz. Negative and positive needle polarity are compared. We used cross-correlation spectroscopy (CCS) that provides sufficient spatial and temporal resolution, high sensitivity, and is suitable for the investigation of randomly appearing discharges [2].

2. Results

The temporal evolution of the TS was recorded for several spectral bands and lines: the second positive system SPS of N_2 (337.1 nm), the first negative system FNS of N_2^+ (391.4 nm), and atomic oxygen (777.1 nm).

In the positive polarity, primary and secondary streamers are observed, both propagating from the needle anode towards the planar cathode (Fig. 1). During the primary streamer, the emission of the SPS dominates, but weak emissions of the FNS and O* are also observed. During the secondary streamer, only SPS emission is obtained. During the streamer-to-spark transition, the emission comes from the atomic lines and the FNS, but no SPS emission was observed.

In the negative polarity, the SPS emission propagating from the needle cathode towards the anode dominates during the initial discharge phase, similar as seen in Trichel pulses. When the SPS emission reaches the anode, the emissions of FNS and O* appear in the whole gap. In the SPS signal we observed another event moving towards the cathode (Fig. 2), assumed as backward propagating streamer.

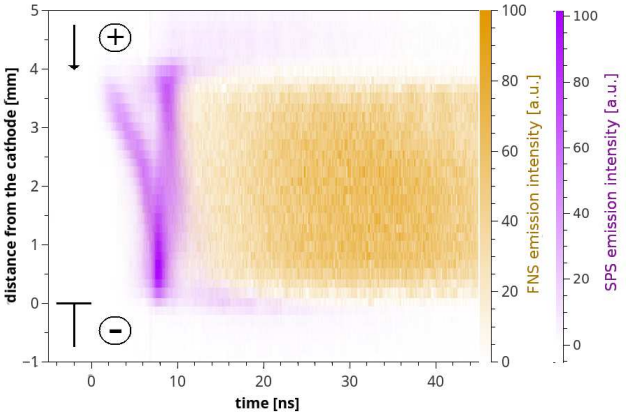

Fig. 1: CCS record of the TS evolution, positive polarity.

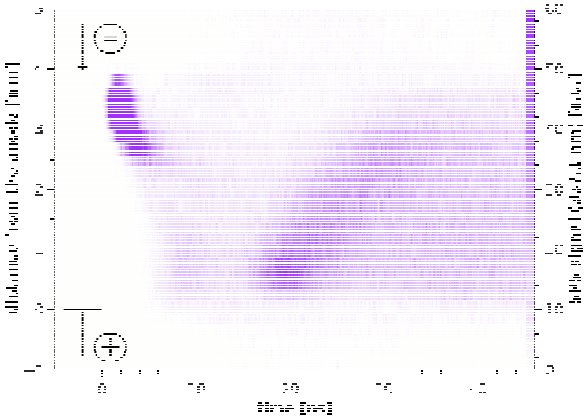

Fig. 2: CCS record of the TS evolution, negative polarity.

3. References

[1] M. Janda, V. Martišovitš, Z. Machala, Plasma Sources Sci. Technol. **20** (2011) 035015.

[2] T. Hoder, M. Cernak, J. Paillol, D. Loffhagen, R. Brandenburg, Phys. Rev. E **86** (2012) 055401.

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