Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **4131** Type: **Invited Speaker / Conférencier(ère) invité(e)**

How to obtain an Atmospheric Pressure Townsend Discharges (APTD) in various molecular gases?

Wednesday 29 May 2024 13:30 (30 minutes)

Dielectric Barrier Discharges (DBDs) can be used for many atmospheric pressure applications, including thin-film coating, sterilisation, treatment of flue and toxic gases, aerodynamic flow control, and energy-efficient lighting devices [1-3]. Depending on the gas, electrical parameters, and electrode configuration, these discharges can operate in the classical filamentary mode or in a homogeneous mode [4-5]. The filamentary mode can be very restrictive for some applications (e.g. surface coating). Nevertheless, conditions to get a homogeneous DBD can also be restrictive. Homogeneous DBDs at atmospheric pressure have been obtained in helium, argon, and nitrogen [5]. In nitrogen, the ionisation level is too low to allow the formation of a cathode fall. Thus, the electrical field is quasi-uniform over the discharge gap, like in low-pressure Townsend discharges, and the obtained discharge is called Atmospheric Pressure Townsend Discharge (APTD) [5]. For a Townsend breakdown to occur, a production source of secondary electrons is necessary to sustain the APTD when the electric field is low.

This work aims to synthesise the mechanisms that could be at the origin of the production of seed electrons in various molecular gases and to understand how to favorise promote the obtention of a Townsend breakdown in various molecular gases. Then, during this presentation, a non-exhaustive overview of the different pre-ionization mechanisms will be provided, and the effect of the main experimental parameters (dielectric materials, gas flow, impurities, shape and frequency of the applied voltage, ⋯) will be discussed. The presentation will be illustrated by the results of APTD obtained in various gases such as N2, N2 + oxidizing gases (O2, NO, N2O), Air [7], CO2 [6], N2O ⋯

[1] S. Samukawa et al., J. Phys. D: Appl. Phys. 45 (2012) 253001
[2] I Adamovich et al., J. Phys. D: Appl. Phys. 55 (2022) 373001
[3] U. Kogelschatz, Plasma Chem Plasma P 23 (1), 1-46 (2003)
[4] R. Brandenburg, Plasma Sources Sci. Technol. (2017) 26 053001
[5] F. Massines et al., Eur. Phys. J. Appl. Phys. 47, 22805 (2009)
[6] C. Bajon et al., Plasma Sources Sci. Technol. (2023) 32 045012
[7] A. Belinger et al., J. Phys. D: Appl. Phys., 2022, 55 (46), pp.465201

Keyword-1

dielectric barrier discharge

Keyword-2

diffuse discharge

Keyword-3

atmospheric pressure

Author: NAUDE, Nicolas (Université de Toulouse - LAPLACE)

Co-authors: DAP, Simon; Dr BELIGNER, Antoine (Université de Toulouse - LAPLACE); Mrs HATON, Julie (LAPLACE, Université de Toulouse); Mr BAJON, Corentin (LAPLACE, Université de Toulouse); Mrs TYL, Clémence (LAPLACE, Université de Toulouse); Mrs LIN, Xi (LAPLACE, Université de Toulouse); Dr GUAITELLA, Olivier (LPP - Ecole Polytechnique); Prof. HODER, Tomas (Department of Physical Electronics - Masaryk University); Dr HÖFT, Hans (Leibniz Institute for Plasma Science and Technology (INP)); Prof. BRANDENBURG, Ronny (Leibniz Institute for Plasma Science and Technology - University of Rostock)

Presenter: NAUDE, Nicolas (Université de Toulouse - LAPLACE)

Session Classification: (DPP) W3-5 Plasma Physics and Technology | Physique et technologie des plasmas (DPP)

Track Classification: Symposia Day (Wed May 29) / Journée de symposiums (Mercredi 29 mai): Symposia Day (DPP - DPP) - Plasma Physics and Technology | Physique et technologie des plasmas