



Formation of rons including ONOO- and O₂ .- in physiological buffers exposed to cold atmospheric plasmas

Fanny Girard-Sahun, Vasilica-Adriana Badets, Pauline Lefrançois, Sylvie Blanc, Neso Sojic, Stéphane Arbault, Franck Clement

► To cite this version:

Fanny Girard-Sahun, Vasilica-Adriana Badets, Pauline Lefrançois, Sylvie Blanc, Neso Sojic, et al.. Formation of rons including ONOO- and O₂ .- in physiological buffers exposed to cold atmospheric plasmas. 6th International Workshop on Plasma for Cancer Treatment, Apr 2019, Antwerp, Belgium. hal-02183237

HAL Id: hal-02183237

<https://univ-pau.hal.science/hal-02183237>

Submitted on 23 Aug 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

FORMATION OF RONS INCLUDING ONOO⁻ AND O₂^{o-} IN PHYSIOLOGICAL BUFFERS EXPOSED TO COLD ATMOSPHERIC PLASMAS

**Fanny Girard-Sahun¹, Vasilica Badets², Pauline Lefrançois², Sylvie Blanc¹, Neso Sojic²,
Stéphane Arbault², Franck Clément¹**

¹ UPPA, IPREM, CNRS UMR 5254, 2 av Président Angot, Pau, 64000, France

² Univ. BORDEAUX, ISM, CNRS UMR 5255, NSysA Group ENSCBP, Pessac, 33607, France
email: girard-fanny5@orange.fr, stephane.arbault@enscbp.fr, franck.clement@univ-pau.fr

Plasma-liquid interactions are increasingly studied over the last years, within the framework of biomedical applications of cold atmospheric plasmas (CAPs). Among various energy components of CAPs, reactive oxygen and nitrogen species (RONS) play a key role in the reported biological effects [1]. Stable ones (H₂O₂, NO₂⁻, NO₃⁻) remain in the liquid during several hours after CAP treatment and can be detected by different methods [2]. A major challenge consists of the detection and quantification of the unstable and very reactive forms of RONS (such as O₂^{o-}, NO^o or ONOO⁻).

Herein, the generation of RONS by CAPs in a common physiological buffer (PBS, pH 7.4) was investigated. Plasma device consists of the formation of guided ionizing waves with the control of the gaseous environment. Correlations between plasma gaseous compositions and induced-chemistry in PBS have been studied by electrochemistry and UV-Visible absorption spectroscopy. First, the chemically stable RONS (hour time-scale) were determined for various surrounding environments. Secondly, the unstable RONS (< sec. at physiological pH) were analyzed following two innovative and complementary approaches; the first one consists in stabilizing RONS by switching the pH of PBS to alkaline values, while the second one consists in analyzing RONS generation close to the plasma-liquid interface owing to an *in situ* and in real time electrochemical detection with microelectrodes. Following this dual protocol, we demonstrated the presence and quantified the highly reactive peroxyntirite ONOO⁻, a biologically nitrating and nitrosating species, which ends up in stable NO₂⁻ and NO₃⁻ species, as observed after minutes and hours post-treatment ([2], [3]). Moreover, *in situ* electrochemistry gave information about the liquid chemistry occurring in the first minutes of plasma treatment and allowed the detection of superoxide O₂^{o-} heavily depending on the gaseous environment of the CAPs.

References

- [1] D. B. Graves, *Journal of Physics Applied Physics*, 45 (26), 263001 (2012)
- [2] F. Girard, V. Badets, S. Blanc, K. Gazeli, L. Marlin, L. Authier, P. Svarnas, N. Sojic, F. Clément, and S. Arbault, *RSC Advances*, 6 (82), 78457–78467 (2016)
- [3] F. Girard, M. Peret, N. Dumont, V. Badets, S. Blanc, K. Gazeli, C. Noël, T. Belmonte, L. Marlin, J-P. Cambus, G. Simon, N. Sojic, B. Held, S. Arbault and F. Clément, *Physical Chemistry Chemical Physics*, 20, 9198-9210 (2018)