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Plasma/target interactions in biomedical applications of cold atmospheric pressure plasmas

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The last decade has seen an impressive increase of the research dedicated to the biomedical applications of low temperature plasmas, especially with plasma sources working at atmospheric pressure. In this new trend, beside decontamination/sterilization and surface treatment which have already a quite long story through low pressure plasma research and developments, medical applications are tacking an increasing place underlined by the actual numerous clinical trials. Medical applications of low temperature plasmas now concern a very wide range of domains, including primary hemostasis and blood coagulation, dental care, skin decontamination and hygiene, wound and ulcer treatment, dermatology, cancer treatment. Biological applications are also now extended to agriculture and, more recently, to cosmetic. Despite the huge number of in vitro and in vivo experiments there are still numerous challenges to overcome linked to the nature of the encountered target (biological tissues and materials, organs and their direct environment, liquids) that have a direct effect on the produced plasma itself and on the generated species.

In this talk, after a presentation of the context, the plasma devices, and the main applications, we will focus on the different problems linked to the plasma/target interaction, including treatments of tissues and liquids. Beside the induced changes in gas flow, the radical production and the potential role of the strong electric field generated around the plasma plume of atmospheric plasma jet systems, we will discuss possible changes induced in microenvironment of living targets. Throughout this presentation, we will emphasize on the fact that plasma diagnostics must be performed in real treatment conditions. We will also tackle the main issues, challenges and opportunities linked to the control of these multimodal action of non-equilibrium cold plasmas on living organisms.

Keywords

Atmospheric pressure plasma
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biological applications
plasma tissue interactions
plasma liquid interactions