

Technical Meeting on Emerging Applications of Plasma Science and Technology

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PLASMA MEDICINE: CURRENT STATUS AND PERSPECTIVES

Wednesday, September 20, 2023 10:00 AM (30 minutes)

Plasma medicine, defined as the application of non-equilibrium plasmas for therapeutic purposes, has made tremendous progress over the last decade, becoming a lively transdisciplinary research field where expertises from life sciences and medicine are combined with plasma physics, chemistry and engineering. Plasma application in wound healing is well on its way into clinical routine and several other avenues are being currently pursued, chief among which cancer treatment.

A large number of devices is now in experimental or clinical application, but two architectures are dominating: dielectric barrier discharges (DBD) and plasma jets (PJ); these devices work in ambient air conditions or using ambient air as the working gas for plasma generation, resulting in the production of reactive oxygen and nitrogen species (ROS, RNS). The composition and quantity of ROS and RNS, currently identified as the principal plasma agents inducing specific biological effects, depends on the plasma device, operating conditions, ambient conditions and, if present, plasma contact with other media beyond atmospheric air (e.g. liquid phases).

Given the role of ROS and RNS in plasma treatment, redox biology is serving as a scientific basis to understand molecular mechanisms of the biological effects of plasmas; among the most important results of current studies, mutagenic and genotoxic effects can be excluded given proper application of plasma devices.

Four major challenges have been recently identified for plasma medicine: 1) regulatory aspects, 2) the treatment of internal cavities of the bodies, 3) the definition of a concept of dose for medical applications of plasmas and 4) ensuring repeatability of plasma treatments in clinical settings [1].

[1] Foundations of plasmas for medical applications, Plasma Sources Sci. Technol. 31 (2022) 054002

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