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Physical and biological mechanisms of nanosecond- and microsecond-pulsed FE-DBD plasma interaction with biological objects
DANIL DOBRYNIN, Drexel Plasma Institute — Mechanisms of plasma interaction with living tissues and cells can be quite complex, owing to the complexity of both the plasma and the tissue. Thus, unification of all the mechanisms under one umbrella might not be possible. Here, analysis of interaction of floating electrode dielectric barrier discharge (FE-DBD) with living tissues and cells is presented and biological and physical mechanisms are discussed. In physical mechanisms, charged species are identified as the major contributors to the desired effect and a mechanism of this interaction is proposed. Biological mechanisms are also addressed and a hypothesis of plasma selectivity and its effects is offered. Spatially uniform nanosecond and sub-nanosecond short-pulsed dielectric barrier discharge plasmas are gaining popularity in biological and medical applications due to their increased uniformity, lower plasma temperature, lower surface power density, and higher concentration of the active species produced. In this presentation we will compare microsecond pulsed plasmas with nanosecond driven systems and their applications in biology and medicine with specific focus on wound healing and tissue regeneration. Transition from negative to positive streamer will be discussed with proposed hypothesis of uniformity mechanisms of positive streamer and the reduced dependence on morphology and surface chemistry of the second electrode (human body) being treated. Uniform plasma offers a more uniform delivery of active species to the tissue/surface being treated thus leading to better control over the biological results.

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