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Controlling Fluences of Reactive Species Produced by Multipulse DBDs onto Wet Tissue: Frequency and Liquid Thickness[1] WEI TIAN, MARK J. KUSHNER, University of Michigan — Tissue covered by a thin liquid layer treated by atmospheric pressure plasmas for biomedical applications ultimately requires a reproducible protocol for human healthcare. The outcomes of wet tissue treatment by dielectric barrier discharges (DBDs) depend on the plasma dose which determines the integral fluences of radicals and ions onto the tissue. These fluences are controlled in part by frequency and liquid thickness. In this paper, we report on results from a computational investigation of multipulse DBDs interacting with wet tissue. The DBDs were simulated for 100 stationary or random streamers at different repetition rates and liquid thicknesses followed by 10 s to 2 min of afterglow. At 100 Hz, NO_{aq} and OH_{aq} are mixed by randomly striking streamers, although they have different rates of solvation. NO_{aq} is nearly completely consumed by reactions with OH_{aq} at the liquid surface. Only H_2O_{2aq}, produced through OH_{aq} mutual reactions, survives to reach the tissue. After 100 pulses, the liquid becomes ozone-rich, in which the nitrous ion, $NO^-_{2\ aq}$, is converted to the nitric ion, $NO^-_{3\ aq}$. Reducing the pulse frequency to 10 Hz results in significant fluence of NO_{aq} to the tissue as NO_{aq} can escape during the interpulse period from the liquid surface where OH_{aq} is formed. For the same reason, $NO^-_{2\ aq}$ can also reach deeper into the liquid at lower frequency. Frequency and thickness of the liquid are methods to control the plasma produced aqueous species to the underlying tissue.

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Mark Kushner
Univ of Michigan - Ann Arbor

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