Abstract for an Invited Paper
for the GEC10 Meeting of
The American Physical Society

Interactions of multiple atmospheric pressure plasma jets and DNA[1]

DEBORAH O'CONNELL, Centre for Plasma Physics, Queens University Belfast, UK

Cold atmospheric pressure plasmas offer a unique environment for treatment of soft materials, including bio-materials and living tissue. Single plasma devices can be as small as micro-meters allowing very precise treatments reducing damage to surrounding healthy living cells. While multiple devices arranged in arrays also allow large area and even 3-dimensional treatment. When two or more cold plasmas are brought close enough together the interaction zone itself can enter a new regime of operation offering the possibility of improved control and manipulation of the plasma chemical environment for applications. The interaction dynamics between two plasma jets is investigated. Individual plasma jets operated between 2 kHz and 40 MHz, in He/O_2 gas mixtures, are allowed to interact with each other. Depending on the electric field configuration of the individual plasmas the interaction itself is dominated by different plasma energy carriers – either charged, neutral species or radiation. For biological treatment reactive oxygen species have been identified as important. Absolute densities of various important neutral species are measured: atomic oxygen, ozone, molecular singlet delta oxygen. For biological applications it is imperative to determine and assess potential damage and risk. Plasmid DNA is exposed to the plasma interaction environment and we quantitatively determine the rate of single (SSB) and double strand breaks (DSB) as a function of various plasma parameters. In order to determine the relevance of these species SSB and DSB rates are directly correlated to absolute species densities. Control strategies are also developed for manipulating these species.

[1]Funded through an EPSRC Career Acceleration Fellowship.