NON-EQUILIBRIUM NANOSCALE NANOSECOND PLASMA DISCHARGE IN LIQUID FOR BIOMEDICAL APPLICATIONS

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Generation of plasma in liquid phase and at liquid interfaces has been previously restricted to thermal plasma for a variety of applications. The new and emerging field of plasma medicine provides a clear demand for development of non-thermal plasma for generation in liquid phase and at liquid interfaces. Primary application of such plasma includes sterilization applications for prosthetic implants related both to generation of reactive oxygen species as well as activation of antibiotics contained within the polymerized surfaces of the implants.

Present work show that sharp tips, on the order of hundreds of nanometers, as well as carbon nano-tubes are capable of igniting a non-equilibrium corona when pulsed with high voltages for periods of time not exceeding 100ns in liquids of various conductivities. Previous work to generate plasma in liquid of high conductivity is often problematic due to energy lost in the bulk liquid. Utilizing the nanosecond pulse with sufficient fast rise times, we have been able to successfully develop both negative and positive polarity non-thermal plasma which is capable of development under such conditions.

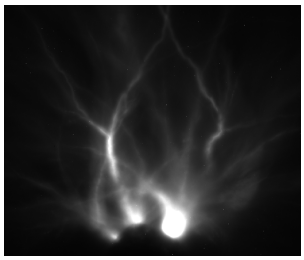

Figure 1: Non-Thermal Corona Discharge In Liquid Phase