

MEM PhD Dissertation Defense

UNIFORM DIELECTRIC BARRIER DISCHARGE WITH NANOSECOND PULSE EXCITATION FOR BIOMEDICAL APPLICATIONS

Halim Ayan

Advisor: Dr. Gary Friedman

Co-Advisor: Dr. Alexander Fridman

Date: Monday, July 20th, 2009

Time: 2:00pm

Place: MEM Seminar Room (162 Curtis Hall)

Abstract

For some period of time the use of plasma in medicine has been limited to thermal discharges for cauterization and dissection. The effects of thermal plasma on tissue are entirely related to local heating. Non-thermal plasma, on the other hand, can have many different modes of interaction with tissue. It has been recently demonstrated that direct treatment of smooth surfaces by non-thermal dielectric barrier discharge (DBD) in air is highly effective in killing pathogens. Moreover, DBD can create different sub-lethal and selective effects. These results hold significant promise for medical applications such as sterilization of wound surfaces. However, a typical DBD in air can be highly non-uniform, particularly on topographically non-uniform surfaces such as most of the living tissues. This creates significant limitations for use of DBDs in wound care and other biomedical applications. In this thesis, a novel non-thermal plasma system, namely nanosecond-pulsed DBD, has been developed and investigated to address this important limitation. Nanosecond-pulsed DBD is shown to be uniform in atmospheric pressure air and much more effective in killing bacteria than conventional DBDs, particularly on topographically non-uniform surfaces. Thus, this new plasma system is potentially convenient for *in vivo* and hospital sterilization cases.