PLASMA STERILIZATION OF COMPLEX BIOLOGICAL SURFACES: MECHANISMS AND APPLICATIONS*

Greg Fridman, Alexander Rabinovich, Suresh Joshi,
Danil Dobrynin, Moogega Cooper, Adam Yost, Sin Park,
Natalie Shainsky
Drexel Plasma Institute, Drexel University,
Philadelphia, PA 19104 USA

Traditionally used thermal, UV, or chemical sterilization cannot always be applied. UV, for example, sterilizes in line-of-sight while thermal treatments can only be applied under certain special conditions. Non-equilibrium atmospheric pressure plasmas are an emergent tool in medicine and bioengineering capable not of rapid localized inactivation of various pathogenic organisms without damage to the surface being treated.

Discussed in the presentation will be the results of inactivation of gram positive and gram negative bacteria, and spores. Biochemical inactivation mechanisms will be addressed where it is shown that inactivation, in most cases, may be primarily due to charge-assisted catalysis of oxidation processes. The applicability of this technique in real-life applications will be shown through inactivation of bacteria in air and water but the main focus will be on complex surfaces where bacteria are either in bio-film form or are otherwise "hidden" by the morphology of the surface, contamination with debris, and in a wound situation where the pathogens are protected from external disturbances by layers of dead tissue and coagulated blood.

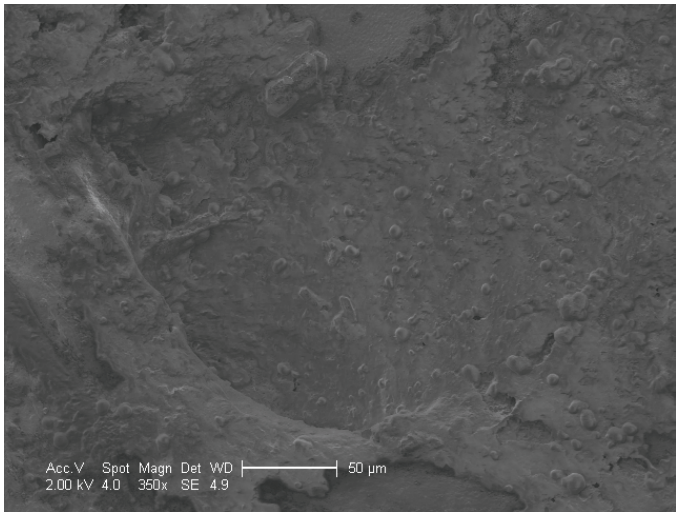

Fig. 1. SEM image of the skin pore with bacterial flora.

* Work sponsored in part by NASA and TATRC.