

Determination of Plasma Parameters of a Low-Pressure VHF-CCP used for Sterilization

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Sterilization and decontamination of medical instruments and implants made out of new high performance synthetic materials are a key issue in modern medicine. However, established sterilization and decontamination processes are not practical due to the high temperature, toxic agents or radiation used. In the past years the utilization of low-temperature plasmas for sterilization and decontamination purposes has become a promising alternative. It has already been demonstrated that a small and cost-effective VHF-CCP is capable of sterilizing germs and spores and to decontaminate proteins. To further explore the sterilization and decontamination processes several plasma parameters and fluxes of the VHF-CCP were determined.

The discharge was a H₂ plasma driven between 68 MHz to 72 MHz at 10 Pa with a power increased in steps of 100 W from 100 W to 400 W. The measurements were done with and without medical devices in the discharge chamber to investigate the influence onto the parameters. The plasma parameters were determined by Optical Emission Spectroscopy (OES) providing the gas temperature T_g , electron temperature T_e and electron density n_e . With these determined results, the neutral gas flux onto the surface j_g , the Debye length λ_d , plasma frequency ω_p as well as the dissociation, excitation and ionization rates could be calculated. The investigation of spectral lines offered the determination of species.

In order to further explore the sterilization mechanisms, more biological experiments with low pressure plasmas will have to be undertaken, which factor the already gained findings and allow them to interpret more comprehensively.