Cold Atmospheric Plasma Technology for Decontamination of Space Equipment

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Cold atmospheric plasma (CAP) technology is very fast and effective in inactivation of various kinds of microorganisms, like bacteria and endospores. In the field of astronautics, the COSPAR planetary protection policy defines the decontamination requirements of spacecraft components for different space missions [1]. In a first study of using CAP for the decontamination of space equipment we showed its potential as a quite promising alternative to the standard "dry heat" and H_2O_2 methods [2].

Based on the fact that CAP treatment can be applied to sensitive surfaces, due to low temperature, it is often used in the field of sterilization. In a follow-on study we continue the investigations to reach a high application level of the technology. First, we redesign the actual setup to a plasma-gas circulation system, increasing the effectivity of inactivation and the sustainability. In addition, we perform detailed plasma composition measurements by using a FTIR spectrometer and compare the measurements with numerical simulations. This provides an insight into the plasma chemistry and the influence of the prevalent humidity involved in the inactivation of microorganisms. The improved knowledge of plasma-chemistry will finally be utilized to increase the decontamination system for larger facilities. The observed inactivation level of the bioindicator *Bacillus atrophaeus* (D-value = 1.62 min), demonstrates that CAP could be a useful alternative to common sterilization methods. Furthermore, the proposed method for spacecraft facilities could also be applied to the sterilization of sensitive materials, like medical devices.

We will give an overview on the status of the plasma decontamination project and present the first results using the redesigned plasma-gas-circulation system.

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References

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