Plasma Technology for Decontamination of Surfaces

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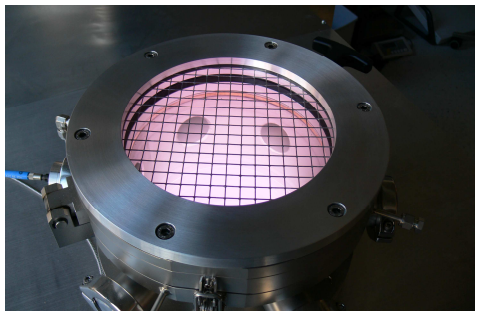
Inactivation of microorganisms and biomolecules with low-temperature plasmas

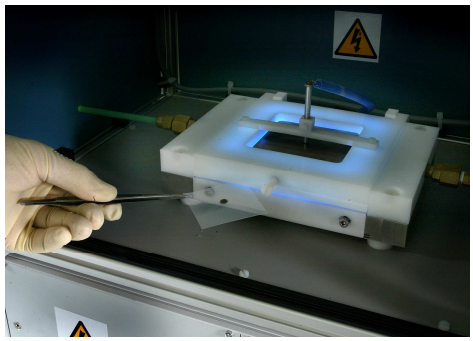
Contamination of surfaces with microorganisms or pathogenic biomolecules (e.g. endotoxins, prions) is a main problem in food industry and medical field. The interactions of low-temperature plasmas and various biological systems are investigated at the Fraunhofer for Process Engineering and Packaging (IVV) in order to establish this promising technology as a new decontamination method for industrial applications. In case of heat sensitive polymers (e.g. PET) new sterilization processes are preferable – for this purpose plasma technology is a future looking alternative.



Low-pressure plasma chamber

Cascaded Dielectric Barrier Discharge (CDBD)

Based on the principle of a silent discharge, the Fraunhofer Institute for Laser Technology (ILT) has developed a modificated set-up for the decontamination of flat packaging material – the cascaded dielectric barrier discharge. The novelty on this innovative system is an integrated excimer flat lamp between the electrodes, which replaces the dielectric and releases monochromatic UV radiation. The emitted wavelength of the excimer lamp can be varied by changing the gas filling of this system (e.g. halogens, noble gases, gas mixtures). Below an increased inactivation effect the additional UV light increases the homogeneity of the plasma in the lower gap (so-called Joshi-effect). In this way the cascaded dielectric barrier discharge combines various inactivation pathways, which effects synergistically and inactivates microorganisms efficiently. Studies with food related polymers like PET, PE or PS did not show significant modifications of characteristic parameters like sealing strength, gas permeability or friction coefficient [Muranyi 2007/2008, Heise 2005].



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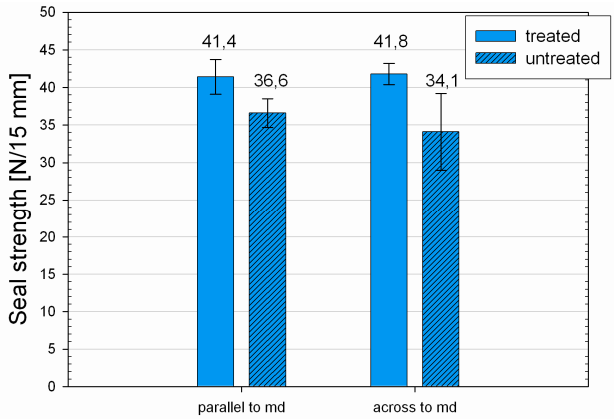
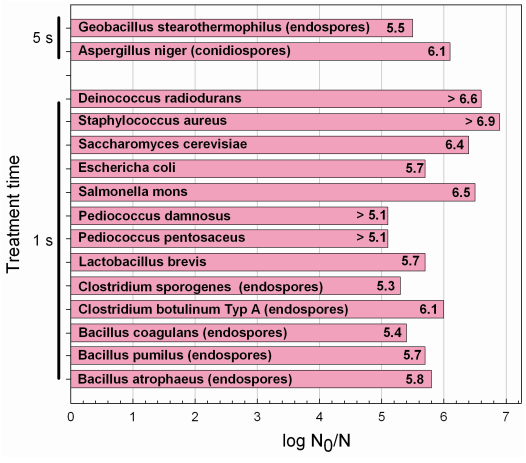


Seal strength of a plasma treated and a untreated PE-LD film
(XeBr*-Excimer; Process gas: laboratory air; Power: approx. 170 W;
Treatment time: 5 s) [Muranyi 2008]



Inactivation efficiency of the CDBD plasma system against various test strains on a PET film
(XeBr*-Excimer; Process gas: laboratory air; Power: approx. 130 W)
[Muranyi et al. 2006]

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