

APPLICATION OF HIGHLY NON-EQUILIBRIUM PLASMA FOR MODIFICATION OF BIOMEDICAL SAMPLES

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Abstract. Non-equilibrium processing of organic materials enables modification of surface properties without changing bulk characteristics of materials. Heavily non-equilibrium state of gas is obtained in a variety of discharges, but electrode-less high frequency discharges are particularly useful. Such discharges often provide plasma with a low ionization fraction (often below 10^{-5}), but the dissociation fraction is often close to 100%. Neutral atoms readily react with organic materials even at room temperature. Depending on the type of organic material, both surface morphology and functionality are modified. The technique is particularly suitable for improvement of biocompatibility as well as for controlled degradation of biological cells. Several examples on the functionalization of polymer materials will be presented. Furthermore, extremely high etching selectivity of neutral oxygen atoms allows for modification of the surface roughness which, in combination with extremely high density of polar surface functional groups leads to superhydrophilic character of some polymers. An interesting application of such technology is for modification of the surface properties of vascular grafts. Plasma treated artificial blood vessels exhibit excellent anti-thrombogenic properties as well as good ability for growing of endothelial cells. The same technique is applied for selective removal of some organic materials from biological cells. Proper treatment allows for revealing the internal structure of biological cells. Examples of treatment of different bacteria are presented.