

PO3040

Effect of sterilization procedures on properties of thin films of plasma polymers

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Plasma polymers are used in various biomedical applications, where they act as interfacial layers modifying biological response of coated objects (e.g. promote or suppress protein adsorption or cell attachment on surfaces). Naturally, the main objective of investigations related to biomedical use of plasma polymers was identification of the conditions leading to the production of coatings having desired bioresponsive properties.

Nevertheless, due to the nature of biomedical applications, the coatings should also withstand a sterilization process, which is, however, somehow overlooked in the literature. This study is therefore focused on this phenomenon, which may be in some cases determinant for the successful use of plasma polymers.

In this study we have selected three kinds of plasma polymers having different bioadhesive nature: plasma polymerized PEO, PTFE and nitrogen-rich films. These plasma polymers were subjected to three sterilization procedures commonly employed in biomedical praxis (dry heat, autoclave and UV radiation treatment) and their physical, chemical and bioresponsive properties were determined by means of different techniques (ellipsometry, AFM, wettability measurements, XPS and biological tests with osteoblast-like cells MG63). The results clearly show that properties of thin films of plasma polymers may be significantly altered by a sterilization process. However, changes induced by selected sterilization methods were found to depend strongly on the sterilized plasma polymer. In other words, there exists no universal sterilization method that assures preservation of properties of all kinds of plasma polymers. This is rather important finding with respect to the design of films of plasma polymers intended to be used in biomedical field: for the successful application of a plasma polymer, there must be also identified suitable sterilization method.

Keywords

plasma polymers

sterilization

biomedical applications