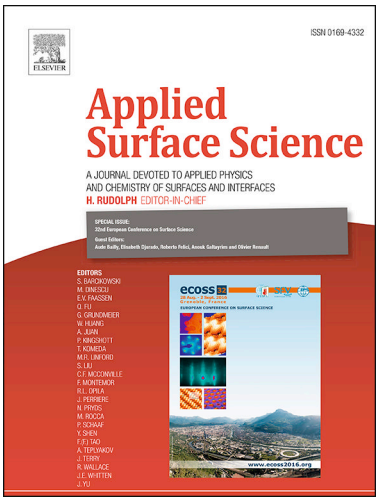

Acrylic acid plasma polymerization for biomedical use

Rim Bitar, Pieter Cools, Nathalie De Geyter, Rino Morent

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Acrylic acid plasma polymerization for biomedical use

Author details

Rim Bitar*, Pieter Cools, Nathalie De Geyter, Rino Morent

Research Unit Plasma Technology, Department of Applied Physics, Ghent University, Ghent, Belgium

*corresponding author: Rim.Bitar@Ugent.be

Abstract

Since a few decades, polymeric materials have played a central role in regenerative medicine and tissue engineering as artificial tissue replacements and organ transplantation devices. Chemical and topographical surface modifications of biomaterials are often required to achieve an overall better biocompatibility. Non-thermal plasma is a non-invasive, solvent-free alternative for modifying polymeric surface properties without affecting the bulk of the material. Plasma polymerization of organic compounds has proven to be an effective tool for thin film production with specific surface chemistries, useful for biomedical applications. These polymer layers have received a growing interest in tissue regeneration and biomolecules immobilization processes. Many different types of chemical functional groups can be introduced, but the focus of this review will be on carboxylic acid groups. Thin films consisting of carboxylic acid functional groups are considered attractive for biomedical applications since these are known for stimulating the adhesion and proliferation of fibroblasts and other kind of cells. Therefore, an overview on the use of acrylic acid (AAc) as a precursor or for the plasma-assisted deposition of carboxylic-group containing-films in bio-interface research activities, will be described in this review. The review will specifically focus on plasma polymerized acrylic acid (PPAA) coatings that are obtained using a variety of plasma deposition techniques. Moreover, the influence of plasma parameters on surface properties such as wettability, surface topography and chemical composition will be discussed in detail. The correlation between different parameters will be studied and a general recipe leading to the successful deposition of COOH-rich stable coatings will be extracted and linked to their ability to improve cell growth, proliferation and differentiation, all leading to the further progress in the biomedical field. A lot of publications claim to have developed suitable coatings for biomedical applications, but neglect the importance of coating stability. For those publications exhibiting sufficient coating stability, a lot of initial in-vitro experiments were performed, but the number in-depth studies on the mechanisms behind the cell-material interactions is limited. Although AAc forms an excellent precursor for biomedical coatings, its potential still needs to be explored in more details.

Keywords: Plasma polymerization, COOH groups, Cell growth, Biomolecule immobilization.