PERFORMANCE OF AMINE-RICH PLASMA POLYMERS IN BIOSENSING AND TISSUE ENGINEERING

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Abstract

Bioapplications of amine thin films, such as biomolecule immobilization in drug delivery systems and biosensors or improved cell proliferation used in tissue engineering require a good film stability in water. However, an improved film stability achieved by increased polymer cross-linking results in a lower density of amine groups for typical allylamine or ammonia/ethylene plasma polymerization process. Cyclopropylamine (CPA) is a non-toxic monomer recently used for the deposition of amine-rich thin films with promising water stability. The electrospun polycaprolactone nanofibers and polystyrene cell cultivation dishes were coated by amine-rich thin films using low pressure capacitively coupled plasma polymerization of CPA in continuous wave and pulsed mode. In pulsed discharges the film exhibited 7 at.% of amine groups and only 1 % of the thickness was lost after immersion of in water for 216 hours. The deposition of this coating improved the cell adhesion and proliferation, as the number of mouse myoblasts grown on the substrate surface during 1 day of cultivation increased by a factor of five after deposition of CPA plasma polymer compared to the uncoated substrate. Additionally, CPA plasma polymerization was employed to deposit stable amine thin films on the surface of quartz crystal microbalance (QCM) biosensors. The antibody specific to human serum albumin (anti-HSA) was attached to the QCM surface via cross-linkage obtained by intermediate reaction with glutaraldehyde. The immunosensor specificity towards the HSA antigen was confirmed by the flow test of QCM sensors.

Keywords: Plasma processing, cell cultivation, biosensor

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