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Analysis of the aging of cell-adhesive plasma-polymer coatings on titanium surfaces

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Plasma polymer deposition is the method of choice for the finishing of metallic implant materials like titanium with nitrogen-containing bioactive coatings. The deposited cell-adhesive plasma polymer films have to possess especial properties such as homogeneity, film stability on air and in different media, sufficient density of functional groups and the appropriate surface charge. But also the knowledge of long-term stability is essential for the application as implant surface. Therefore, aging studies of plasma polymer coatings on titanium surfaces are important to detect the changes of surface chemistry over a longer time period. For this purpose, results of physicochemical surface diagnostics have also to be correlated with adequate tissue culture experiments.
The objective of this paper was to measure surface chemical characteristics of thin plasma polymerized allylamine (PPAAm) coatings on titanium alloys over a time period of one year and to correlate these data with the adhesion of MG-63 osteoblastic cells. XPS and FT-IR (ATR and IRRAS) measurements demonstrate the oxidation of the PPAAm film by post plasma processes, initiated by surface free radicals during sample storage on air. The aging process cannot only be characterized by a loss of about 70 % of primary amino groups within the first 30 days of storage, while the nitrogen content remains nearly stable but also by means of characteristic changes in the IRRAS-spectra by deeper examinations-a key aspect of this paper. Tissue culture experiments with MG-63 human osteoblastic cells demonstrate a considerable enhanced, highly significant adhesion and spreading on a PPAAm coated polished Ti-6Al-4V substrate compared to an untreated one, independent of storage duration.

Keywords
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