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Biofunctional aldehyde- and epoxide-containing surfaces for biomedical applications

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Biofunctional surfaces are suitable for various applications, reaching from promoting the adsorption of specific molecules in order to achieve high biocompatibility and at the same time a defense against bacteria up to the prevention of the interaction between biological materials and the functionalized surface. In the investigations reported here, the control of interaction between biofunctional surfaces and proteins is of major importance for the development of biosensors.
The presented results are about the optimization of a specific chemical functionalization by deposition of plasma polymers exhibiting a high density of electrophilic functional groups. Plasma-enhanced chemical vapour deposition (PECVD) using dielectric barrier discharges (DBDs) allows coating of substrates with various geometries at atmospheric pressure. Thin films with a high retention of functional groups were achieved by plasma polymerization of trans-2-hexen-1-al, an a,b-unsaturated aldehyde, or glycidyl methacrylate (GMA) as precursors. Thickness and chemical composition of the plasma polymers pp-GMA and pp-hexenal were studied by ATR-FTIR spectroscopy and TOF-SIMS measurements. Derivatization of pp-GMA by epoxide ring opening in the presence of HCl vapors can be used to quantify the density of functional groups by FTIR or XPS spectroscopy. Aldehyde coatings were derivatized by reaction with 4-(trifluoromethyl)benzylamin followed by ATR-FTIR-spectroscopy. While a very high retention (> 90 %) of the epoxide group can be achieved during DBD-activated plasma polymerization of GMA, the deposition of pp-hexenal is complicated by multiple possibilities of polymerization of the $–C^1H=C^2H-C^3H=O^4$ moiety: Aside from the desired 1,2 addition, 1,4 and 3,4 additions are possible, too. Promising results obtained by LIONEX GmbH on biomedical applications of the technology mentioned above shall be presented. Research results presented here were obtained within the EU funded project with the acronym “IP4Plasma” and the grant agreement no 604048.

Keywords
Plasma-enhanced chemical vapour deposition