

SURFACE MODIFICATION BY PLASMA POLYMERIZATION AND APPLICATION OF PLASMA POLYMERS AS BIOMATERIALS

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INTRODUCTION: Polymer surface modification is an elegant method for generating functional polymer surfaces combined with the desirable attributes of bulk polymers¹. In present work, di(ethylene glycol) mono vinyl ether (EO2)² and allylamine (AA)³ were employed as plasma monomers. Further more, these plasma polymers were investigated as biomaterials, which included protein adsorption, cell attachment, and DNA immobilization/hybridization.

METHODS: The plasma polymers were deposited in the plasma reactor at continuous wave (cw) and pulsed plasma conditions. The plasma equivalent power is defined as

$$P_{eq} = P_{peak}(t_{on}/t_{off}+t_{on})$$

The chemical properties of the plasma polymers were investigated by Fourier Transform Infrared Spectroscopy (FTIR). Protein adsorption and DNA immobilization or hybridization were detected by Surface Plasmon Resonance Spectroscopy (SPR) and Surface Plasmon Resonance Fluorescence spectroscopy (SPFS)

RESULTS: Chemical properties: For plasma polymerized EO2, according to the definition of the equivalent power, $P_{eq} = P_{peak}(t_{on}/t_{off}+t_{on})$, rising the input power or decreasing t_{off} can make P_{eq} increase, and the ratio of C-O to C-C groups decreases. For plasma polymerized allylamine, the density of amino group increases with decreasing the input power and DC.

Protein adsorption on Plasma polymerized EO2: There is a clear dependence of the protein adsorption affinity on the plasma polymerization condition employed during the film formation, for cw and high DC generated films the extent of adsorption is also somewhat dependent on the plasma polymer thickness. The use of low DCs during the polymer synthesis results in a strongly reduced affinity for protein adsorption. However, the data indicate maximal non-fouling surface structures can be achieved at DCs which are less than the lowest values available for film deposition.

Cell attachment: Compared with the naked glass, it is difficult for cells to attach onto the low DC plasma polyEO2.

DNA immobilization and hybridization on PPA films: DNA adsorption was found to be dependent on the DC, the probe concentration, and the polymer film thickness. The probe DNA thickness increases (d_{probe}) with the DC decreasing. Further more, d_{probe} increases with the low DC and input power plasma polymer thickness increasing within 50 nm thickness of the polymer. At the same time, d_{probe} increases with the probe concentration increasing under 100 nM of probe. It is very easy to distinguish the mismatch two, mismatch one, and mismatch 0 hybridization behaviors for this plasma polymer matrix.

CONCLUSIONS: The plasma polymer possesses the potential properties, which could be applied as biomaterials. In present work, protein adsorption, cell attachment, and DNA immobilization or hybridization were investigated successfully.

REFERENCES: ¹C. -M. Chan, *Polymer Surface Modification and Characterization*, Hanser, München, **1994**. ²Z. Zhang, B. Menges, R. B. Timmons, W. Knoll, R. Foerch, *Langmuir* **2003**, 19, 4765-4770. ³Z. Zhang, Q. Chen, R. W. Knoll, R. Foerch, "DNA immobilization on plasma polymerized allylamine", *Macromolecules*. **2003**. accepted.

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