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COVALENT ATTACHMENT OF FLUORESCENT LABELS TO PLASMA-MODIFIED SURFACES

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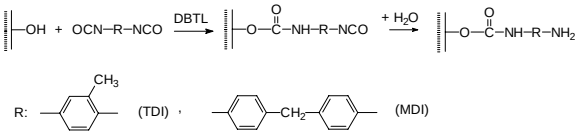
INTRODUCTION: The chemical composition of surfaces plays an important role in many areas like biocompatibility of materials, biosensors, permselectivity of membranes, heterogeneous catalysis, and s.o.. For the adjustment of surface properties, the plasma modification, particularly the plasma functionalization and plasma polymerization with monomers, carrying functional groups, are useful techniques to introduce accurately defined functionalities. Such a modification of the surface provides the opportunity to carry out chemical reactions at surface-bounded functions to covalently attach groups with special features to produce tailored surfaces for different applications.

RESULTS & DISCUSSION: Two ways of surface modifications of PP were used to generate functionalized surfaces. The first one was an oxygen plasma treatment of polypropylene followed by a wet-chemical reduction[1] to transform the different O-containing groups into hydroxyl groups. The number of OH groups was adjusted to 10-14OH/100 C atoms.
The second way was the deposition of plasma polymerized allylamine layers on PP. The number of the so generated primary amino groups amounted up to 18 NH_2 groups/100 C atoms.
The hydroxyl groups of modified PP (PP-OH) were reacted with diisocyanates (TDI, MDI) to get NCO-terminated PP, followed by the reaction with water as given in scheme 1:



Scheme 1

The NCO-modified PP was reacted with NH_2-functionalized fluorophors like dansyl hydrazine, dansyl cadaverine, rhodamine 110 and amino fluoresceine, the NH_2-functionalized PP was reacted with dansyl chloride and fluorescein-isothiocyanate. Fluorescence spectra of PP modified by TDI-linked dansyl hydrazine (DNS-H) are shown in Fig.1:

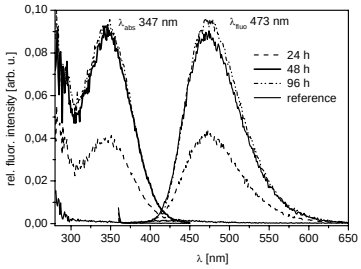


Fig. 1: Fluorescence excitation and emission spectra (uncorrected, excitation wavelength 350 nm;) of DNS-H, bounded to PP-OH, treated various times with TDI

The reaction of plasma polymerized allylamine layers on PP with FITC also resulted in fluorophor-modified surfaces. The fluorescence intensity as well as the S content of the surfaces (S was taken as XPS-tag) showed a linear dependence on the plasma power input.

CONCLUSIONS:
The plasma chemical modification of polymers is suitable for the covalent attachment of special surface functionalities e.g. spacer, sensor or bio molecules as exemplarily demonstrated for surface-bound fluorescent labels. In spite of problems connected with the measurement of the fluorophor tagged foils, described for example by Henneuse-Boxus[3], a correlation between fluorescence intensity and reaction time of the diisocyanate with PP-OH was found.

REFERENCES: [1]J. F. Friedrich, G. Kühn, R. Mix, W. E. S. Unger, (2004) *Polymer Processing and Plasmas* **1**, 28-50. [2] R. Mix, K. Hoffmann, U. Resch-Genger, R. Decker, J. F. Friedrich, *in press.* [3]C. Henneuse-Boxus , A. De Ro, P. Bertrand, J. Marchand-Brynaert, (2000) *Polymer* **41**, 2339-2348

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