NANOTECHNOLOGICAL MODIFICATION OF ELASTOMER SURFACES

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Introduction
With atmospheric pressure plasma it is possible to modify elastomer surfaces without destroying the bulk of the polymer and without etching the surface. Plasma activation and plasma polymerisation have an enormous effect on the surface properties and so on the properties like friction, adhesion, permeation and surface polarity.

Aim of the project
Plasma treatment, polymerisation and activation is used to modify the physical and chemical surface characteristics of NBR and EPDM elastomers. Especially the friction properties of rubbers should be altered by plasma polymerisation.

Results and Discussion
The results of the NBR rubber, sulfur crosslinked and vulcanised without plasticizer, are presented. The NBR surface morphology was investigated by AFM-Microscopy. Especially by using polymerisa-tion of TEOS or HMDSO a change in the topography and surface roughness was detected. The de-position of HMDSO or TEOS thin films increases the surface roughness.
The friction behaviour was determined with an untreated, a HMDSO and a TEOS plasma-treated rub-ber surface with car-glass as substrate. The deposition of HMDSO and TEOS thin films results in a lower effective friction coefficient in comparison with the untreated rubber samples. The smaller con-tact region due to the asperities that were build up by polymerisation of HMDSO or TEOS causes the lower friction coefficient. Furthermore the rubber surface was brought into line with the car-glass sur-face. It can be assumed that a lower friction coefficient originates due to a comparable surface hard-ness or stiffness. The film thickness was measured by AFM. On the one hand the course of the friction coefficient measured at different velocities has been obtained, on the other hand the measurement of the deposited film thickness was measured. By single time deposition a film thickness of 68 nm could be obtained. The deposition was carried out on a Si-Wafer. One side (in this case the left side) was left untreated and the other side was treated by deposition of thin HMDSO-films. With the origi-nated edge it is possible to measure the film thickness.

Conclusions and Outlook
By deposition of TEOS and HMDSO thin films on rubber surfaces a significant lower friction coeffi-cient could be generated. Furthermore the presented measurements will also be done with an EPDM rubber to lower the friction coefficient. In addition plasma treatment should be used to increase the rubber/rubber adhesion and the surface polarity.

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- Nanotechnologische Modifizierung von Elastomeroberflächen mittels PECVD
- Kontaktwinkelmessungen, physikalische Prüfungen, Spektroskopie