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Composition of plasmapolymeric coatings using O2/HMDSO gas mixtures and application on elastomers for tribological improvement

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The composition of plasmapolymeric coatings (SiOx) using O2/HMDSO gas mixtures in a plasma enhanced chemical vapour deposition (PECVD) process can be widely tailored varying the mixing ratio of the process gases as well as the applied power in the deposition process. This article demonstrates the changing properties of those coatings and its capability for reduction of friction regarding elastomers for the application on seals. A reduced friction of sealing rings in an automobile realizes the reduction of CO2 emission due to energy saving.
On the one hand the deposition process was varied regarding the mixing ratio of the process gases oxygen (O2) and Hexamethyldisiloxan (HMDSO) from 1:5 to 18:1 as well as the applied power from 500W to 1500W. On the other hand the friction of three different types of elastomers plasmapolymeric coated as well as uncoated was investigated. These three substrate types were acrylic rubber (ACM), fluoric rubber (FKM/FPM), and nitrile rubber (NBR). The studied coated and uncoated elastomers were tested as flat plates. The friction of elastomers was investigated using an Universal Material Tester (UMT3) system with oscillating Pin-on-plate contact geometry. The tribological tests were runned dry in ambient conditions with a velocity of 200 mm/s. The used normal force represents an initial Hertzian pressure of 1.5 MPa.
It was found that the coefficient of friction μ could be reduced by 84 % of the uncoated elastomers from 1.24 to 0.20 using plasmapolymeric coatings at dry friction as well as could be reduced by 43% from 0.14 to 0.08 at lubricated contact. The nanohardness as well as the Young's modulus, the surface energy and the chemical composition of the plasmapolymeric coatings exhibit a linear dependency. That means the wear resistance could be tailored in relation to the damping behavior of the elastomers.

Keywords
friction reduction
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energy saving
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