New strategies to create technologically relevant superomniphobic coatings on sol-gel base

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preparation of the sol-gel coatings

Background

- superomniphobic, self-cleaning surface coatings are interesting for various applications (windows, solar panels, facades)
- superhydrophobicity is obtained by hydrophobic surfaces with high roughness (hierarchical or fractal structure) [1]: problem: mechanical stability
- superoleophobicity requires high roughness, high aspect ratio and re-entrant structures [2, 3]

Goal

- creation of superhydrophobic, oleophobic coatings by technologically relevant sol-gel process [4] with nanofillers
- systematic investigation of the correlations between surface topography / roughness and wettability
- test of mechanical stability

Methods

- preparation of coatings by sol-gel process with functional nanofillers
- investigation of morphology and roughness on different length scales by confocal microscopy, scanning electron microscopy (SEM), scanning force microscopy (AFM)
- measurement of advancing and receding contact angles of water, water-ethanol mixtures and n-hexadecane
- wet abrasion test similar to DIN EN ISO 11998

composition of the sol-gel coatings

- base coat: blend of "H 1006", inorganic pigments, polyethylene
- sprayed, cross-linked (150°C)
- roughness adjusted by particle size, mixing ratio

coating R1: advancing and receding contact angles of water-ethanol mixtures vs. liquid surface tension $\gamma_l$

coating R1 after wet abrasion test vs. root mean square roughness $r_a$

coating wear of the sol-gel coatings after wet abrasion test vs. root mean square roughness $r_a$

coating S4 after abrasion test

coating S1 after abrasion test

coating S7 after abrasion test

References


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