Development of Conceptually New Fluorine-Free Repellent Textile Finishing

The search for substitutes for fluorinated compounds that maintain performance and durability remains a major challenge for the textile industry. While many examples of superhydrophobic coatings exist, only limited progress has been made in the development of highly oleophobic finishes.

A particular difficulty in developing oleophobic coatings lies in fundamental material limitations related to surface tension. Current approaches, such as generating suitable surface roughness using PDMS or alkyl chains with low surface energy, offer only limited performance.

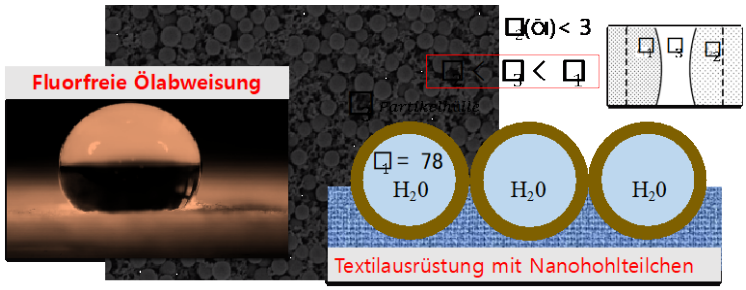
Unlike fluorinated compounds, there are no universal solutions, as oleophobicity - unlike superhydrophobicity - varies significantly depending on the type of oil.
Biomimetic concepts are not applicable, since no examples of superoleophobic surfaces exist in nature.

Research Goal and Approach:

The project aims to develop a new fluorine-free approach based on the established scientific concept of repulsive van der Waals interactions. Indirect evidence from experimental studies suggests that the presence of nanoporosity (so-called *re-entrant structures*) can reduce oil wettability.

Analyzing these experimental findings using a well-established theoretical model points to a solution involving thin layers with a specifically adjusted refractive index that promote repellency.

This project focuses on developing a method for applying thin polymer layers containing SiO_2 nanocapsules with a hydrophilic inner cavity. The main challenge is to combine self-emulsifying amphiphilic copolymers with modified SiO_2 nanocapsules in a textile finishing system.



Details of the research project:

Joint project with DWI Leibniz Institute for Interactive Materials (DWI)

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