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Bio-inspired wrinkled surfaces with anti-adhesive properties against insects

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Insect infestation has a direct impact on agricultural food production and stored products, damages to buildings as well as the human health.

Due to these ramifications a tremendous increase in interest in the research area of insect adhesion to plants and surfaces has been observed in recent years. The elementary comprehension of the biomechanical principles of insect adhesion opens up paths to potential countermeasures.

Prevailing strategies combating insect pests resort to chemical solutions, including toxic insecticides or insect-repellents. Due to their environmental danger, alternative ecofriendly strategies are highly sought after. In particular with the current boost in environmental awareness at all fronts, a revolution in pest control in form of ``green'' chemicals with repeated applications is needed. Current approaches involving natural solutions, such as the use of entomopathogenic fungi, may be dangerous to beneficial insects, other animals or humans. Other strategies entail the preparation of wrinkled slippery films or paints that demonstrated great anti-adhesive properties, but limited applicability. Therefore the work presented in this thesis discusses several aspects in the pursue of environmental friendly anti-adhesives for insects. The biomimetic aspect of mimicking natural structures with a variety of fabrication methods is introduced. The core Chapters 4--6 demonstrate the development of a scalable route for the manufacture of bio-inspired wrinkled films or particles that mimic the topographic domains of biological role models that provide low traction properties to insects. The efficacy of these surfaces in terms of insect repellency is investigated and a successful reduction of insect adhesion by 96% is observed.

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