Nanocomposites and nanomaterials

Sacrificial superhydrophobic coatings

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The superhydrophobic effect requires the presence of nanostructured elements on the material surface. In this conditions, the water contact angle of the material can be more than 150° and contact angle hysteresis can be less than 5°. However, such surfaces have the essential drawback: they are mechanically unstable, their structure can be destroyed even at small mechanical loads [1]. Furthermore, such materials are not wear-resistant and their use for large-scale outdoor applications is limited. The superhydrophobic properties of such materials decrease rapidly during mechanical wear. The common solution to this problem includes the use of elastic substrates for superhydrophobic layer [2] and the providing of superior interphase contact between nanoparticles and the substrate [3]. However, in this cases, the superhydrophobicity is still determined by the existence of ultra-thin surface layer.

In this research, we have examined an assumption that the mechanical robustness can be provided by formation of relatively thick layers (up to 100 μ) of the material, which under the mechanical wear will remain the superhydrophobic properties even in conditions of outer layers removal. This approach was tested on several composites based on acrylic, siloxane and vinyl polymers. The filler system plays a role of the structure forming element. It is shown that using the hierarchical structures principle, such sacrificial coatings can retain superhydrophobicity up to the moment of the full wear failure.

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