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Editorial corner – a personal view

Progress on the development of micro/nano-biomimetic polymer surfaces

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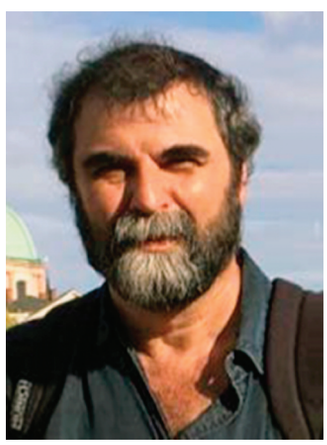
Innovative solutions for different technological sectors can be inspired by some complex multifunctional structures present in nature. The topography of such materials has a drastic influence on interfacial friction, optical interference, hydrophobicity, compatibility and other specific properties. For example, the unique micro-groove skin of sharks drastically reduces friction; the surface of lotus leaves provides a superhydrophobic effect and a self-cleaning capacity; the feet of some reptiles (*e.g.*, gecko) have superadherence; the eyes of some nocturnal insects (*e.g.*, moth) display unusual antireflective properties (https://doi.org/10.1016/j.oceaneng.2020.106962). Organisms needed millions of years to develop these fascinating skills, but nowadays, these functions can be mimicked after an accurate comprehension of general physical principles and materials science and manufacturing technology development. Fulfilling macroscopic mechanical properties together with the indicated special surface characteristics needs an appropriate balance between micro and nanofeatures. Polymers appear as ideal biomimicry materials due to their versatile properties, facility of processing and mass production capability.

Efforts are therefore focused on the replication of natural textures on polymer surfaces. A direct replication process is problematic for properly reproducing all features. Therefore, specific surface treatments (*e.g.*, laser, lithography, electrochemical deposition, wet chemical reaction, self-assembly, chemical vapour deposition or plasma etching) are applied after the production of the initial specimen (https://doi.org/10.1016/j.jcis.2010.08.047). Nevertheless, problems like incomplete regularity and low production rate exist. Injection moulding using textured inserts appears as a promising method to increase the manufacturing cadence. Liquid silicone rubber (LSR) appears to be a suitable polymeric substrate as it has proven biocompatibility and is of great interest in the biomedical industry. Specifically, micro and nanotextured surfaces can be employed in the medical field due to the possibility of rendering antibacterial properties, cell alignment, and high wettability (https://doi.org/10.1002/mame.202100741). Different problems still need to be solved (e.g., the high hardness difference between the insert mould and the polymeric counterpart). Traditional theories and concepts require some revision to face the enormous challenges raised by the emerging phenomena and exploit all their potential applications. In any case, the selection of materials, processing and fabrication methods are primordial for the success of new biomimetic devices.



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