Title: Improving the sustainability of engineering technologies and devices by tailoring their surfaces tribological properties.

Abstract

The demand of adhesives, sealants, hydro-repellent surfaces and low frictional material is constantly growing every year. This increasing demand is associated with the requirements of extremely low environmental impact and much better durability and failure resistance of engineering materials and components. It has to be considered that that the 23% (about 119 EJ) of the world's total energy consumption originates from tribological interactions and interfaces. The development of new surfaces, materials, and lubrication technologies may, indeed, reduce energy losses due to friction and wear by 40%. However, our ability to manipulate and control surface properties as adhesion, friction and wetting is still marginal. A deeper understanding of such phenomena is, then, a crucial step to mitigate the economic losses and environmental impact. Adhesive/anti-adhesive and frictional materials are indeed employed in a wide range of industrial and technological applications, spanning several length-scales from the macro world - construction, motor vehicles, durables manufacturing - to the micro/nano world - MEMS/NEMS devices, microfluidics, biomedical and biotechnological systems, magnetic storage and recording systems. Depending on the type of application, adhesion, friction, and wettability should be either increased or reduced. Tribological properties can be manipulated by controlling surface roughness or by adding specific micro- and nano- structures at the interface. Multi-scale modelling and theoretical approaches aimed to identify proper geometrical sub-structural interfaces are key steps towards the fabrication of sustainable engineering devices.