Graft Copolymers and Bottlebrushes at Surfaces for Tuning Physicochemical and Tribological Properties of Materials

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The functionalization of inorganic and organic surfaces by highly branched, functional polymer adsorbates enables a fine tuning of the interfacial physicochemical properties and allows one to determine the interaction of the modified support with the surrounding environment. This is valid on metal oxide surfaces, where graft copolymers featuring different compositions and side chain topologies can assemble forming biopassive and lubricious interfaces. Alternatively, from similar inorganic substrates, bottlebrushes with controlled molar mass and side chain length can be grown exploiting controlled radical polymerization (CRP) methods, enabling a broad modulation of steric stabilization of the surface, and tuning its biopassivity and nanotribological properties.
The design concepts and functionalization strategies applied for model inorganic materials can be additionally enlarged to complex tissue surfaces such as articular cartilage, where highly branched, biocompatible copolymers can replace structurally similar biomacromolecules responsible for protection and lubrication of the underlying tissue.
In this contribution, the influence of polymer architecture and composition on the fabrication and properties of graft copolymer- and bottlebrush-based interfaces will be discussed, bringing the above-mentioned cases as examples of highly-technologically-relevant applications.