Polymers at Synthetic and Biological Surfaces

Harm-Anton Klok

Ecole Polytechnique Fédérale de Lausanne (EPFL)
Institut des Matériaux, Laboratoire des Polymères
STI - IMX – LP, MXD 112 (Batiment MXD), Station 12
CH-1015 Lausanne (Switzerland)

Polymer science provides a diverse toolbox to modify and control the properties and function of synthetic and biological surfaces.

The first part of this lecture will focus on synthetic surfaces and discuss the use of surface-initiated, controlled radical polymerization (SI-CRP) techniques for the preparation of thin, surface tethered polymer films, which are often colloquially referred to as polymer brushes. SI-CRP reactions are characterized by a number of unique features, which include the ability to (i) prepare polymer brushes with precise control over chemical composition and film thickness; (ii) generate polymer films that present very high surface concentrations of functional groups; (iii) conformally coat both simple, planar substrates as well as complex, 3D structured or porous substrates and (iv) tune the conformation of the surface grafted polymer chains. This presentation will highlight recent work from our laboratory that illustrates the use of SI-CRP to generate thin polymer films with sensory or responsive properties as well as results from recent work, which show that the stretched conformation of these surface grafted polymer chains also has an impact on their chemical reactivity, potentially opening avenues towards novel mechanically responsive surfaces.

The second part of this talk will concentrate on biological surfaces and more specifically the membrane of living cells. Living cells, and in particular those from the adaptive immune system, are attractive as carriers to mediate transport of drug-loaded micro- or nanoparticles as they potentially provide possibilities to home in to the disease site in a highly selective manner. The successful use of cells as carriers for polymers and polymer particles requires chemical approaches that allow to immobilize (and release) the polymer or particle payload from the cell surface, without compromising cell viability and function. This presentation will discuss various polymer cell surface modification strategies and compare these different approaches in terms of the possibilities they offer to modify cell surfaces as well as their impact on cell viability and function. It will be shown that under appropriate conditions live cells can be surface modified with synthetic polymers while retaining their viability and functional properties.