

Nanostructured polymeric multilayers for biomedical applications

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Appositely charged polyelectrolytes may be assembled into nanostructured multilayered films using the layer-by-layer technology, where the consecutive layers are well stabilized by electrostatic interactions or other weak forces. Using adequate templates, non-flat coatings can be fabricated with tuned compositions along the build-up assembly. This enables the production of very well controlled multifunctional and structural devices using mild processing conditions that could be useful in biomedicine, including in tissue engineering or in drug delivery. In such applications, where there is a direct interaction between the implant with tissues and cells, the biomaterials must exhibit adequate surface characteristics, both at the chemical and topographic points of view. Such systems should also respond adequately to external variables or cellular stimuli. Examples of nano-stratified surfaces with tuned characteristics are presented, using polysaccharides or synthetic biomimetic macromolecules prepared by recombinant biotechnology routes. In particular, methodologies will be discussed to produce: (i) controlled surfaces with stimuli-responsiveness capability (e.g. to temperature or pH) or exhibiting other specific properties (for example, adhesiveness); (ii) Hierarchical organised multifunctional capsules for the controlled delivery of bioactive agents; and (iii) 3-dimensional devices for cell colonisation (e.g. capsules or scaffolds).