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POLYELECTROLYTES AS BUILDING BLOCKS IN NANOTECHNOLOGY

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Polyelectrolytes, polymer molecules with charged repeating units, are particularly interesting for nanotechnological applications since they have the capability of changing conformation and size in response to external stimuli and mimic a wide range of natural occurring polymers. Indeed, in nature polyelectrolytes are already used as building blocks: DNA, proteins, and other biopolymers, together form working nanoscale devices such as viruses, bacteria and ultimately cells of higher organisms.

Two different nanofabrication techniques employing polyelectrolytes: the Layer by Layer (LBL) technique and the in situ brush synthesis will applied for the fabrication of bio nano devices for drug delivery and sensing.

The LBL technique is based on the alternative assembly of oppositely charged polyelectrolyte layers to form a thin polymer film. Brushes are monolayers of polymer chains with a side anchored to a surface and the other side free. Polymer chains in a brush retain much of the conformational freedom of macromolecules in solution and show a high capacity to adapt to changes in the environment (pH, ionic strength, temperature). While LBL films films provide the means to control composition and thickness at the nanoscale in vertical direction of a film, polyelectrolyte brushes have a dynamic character with the capacity of responding to the media with changes in the nanometric range.

Both techniques can be used to design in a hierarchical way complex surfaces with various physical and chemical functionalities, including biological and artificial materials.

In this presentation the tailoring of nanoparticles (PLGA, silica, CNTs, etc) and planar surfaces with LBL films or brushes will be presented. On top of the polymer cushion lipids layers, biomolecules and eventually virus particles have been assembled providing to the nanoparticles specific features. Flowcytometry, Confocal Microscopy, TEM and zeta potential measurements have been applied for the characterization of the

nanoparticles and their functionalization. In addition, QCM-D, AFM and contact angle measurements have been performed on planar surfaces.

References

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