

MULTIFUNCTIONAL SYNTHETIC NANOBIOINTERFACES

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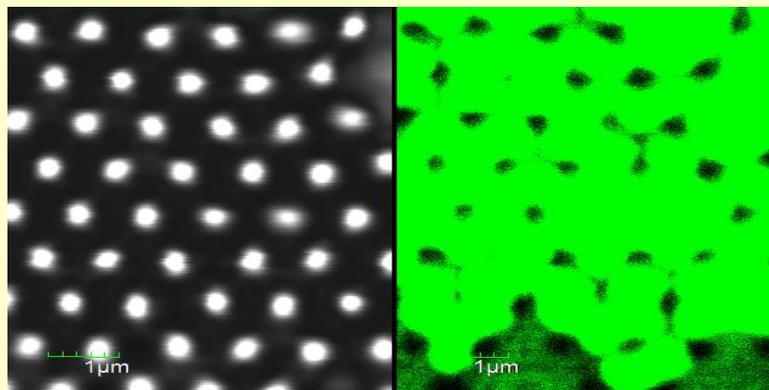


Fig 1. Confocal microscopy images (left hand side: bright field, right hand side: emission) for a hybrid thin film of an inorganic polymer (green) and polystyrene microspheres prepared by colloidal lithography

The aim of this research is the preparation and physico-chemical characterization of new materials having a multifunctional surface behavior (both topography and chemistry patterned at the micro- and nanoscale), especially towards the interaction with systems of biological interest. The investigated systems include (i) laterally confined proteins and supported lipid bilayers for biosensing applications; (ii) controlled immobilization of peptides/proteins for tuning the cellular adhesion, spreading and migration for potential applications in tissue engineering and regenerative medicine.

Keywords: hybrid nanoplateforms, surface functionalization, lipid bilayers, proteins, cell guidance

1. Electrostatically-driven protein interaction with supported lipid bilayers

The assembling of nanoscale building blocks which consist of biomolecule-associated supported lipid bilayers (SLBs) is obtained by spontaneous adsorption and fusion of unilamellar phospholipid vesicles on polar substrate materials, followed by adsorption of the protein.

One case study is that of ferritin immobilization on SLBs made from zwitterionic 1-palmitoyl-2-oleyl-sn-glycero-3-phosphocholine (POPC), anionic 1-hexadecanoyl-2-(9Z-octadecenoyl)-sn-glycero-3-phospho-L-serine (POPS) and cationic 1,2-dioleoyl-sn-glycero-3-ethylphosphocholine (POEPC) lipids. Ferritin is a protein cage supramolecule which recently has attracted much attention as building block for novel functional nanostructure fabrication, because it can accommodate a variety of nanometer size inorganic materials within its interior space. The electrostatic-driven interaction of horse spleen ferritin onto SLBs at different charges/compositions is investigated by quartz crystal microbalance with dissipation monitoring, surface plasmon resonance and confocal microscopy.

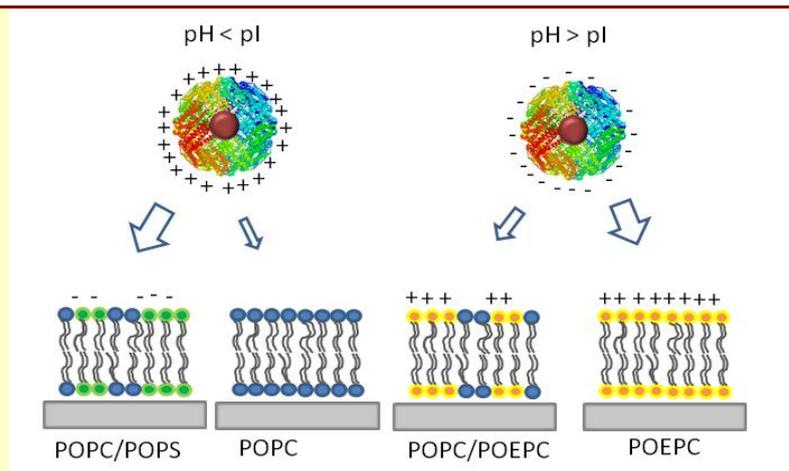


Fig 2. Schematic illustration showing the interaction between positively charged ferritin (at lower pH than the isoelectric value, pI) and negatively charged SLBs or the reverse

2. Surface immobilization of fibronectin-derived peptides for cell guidance

The cell attachment and adhesion to hydrophilic or hydrophobic surfaces is modulated by the immobilization by weak forces (reversible behavior) – also on surfaces nanostructured via soft lithography approaches - of integrin-binding peptide fragments from fibronectin.

Collaborations

- Prof. Bengt Kasemo, Department of Applied Physics, Chalmers University of Technology, Gothenburg, Sweden
- Prof. François Reniers, Chemistry department, Université Libre de Bruxelles, Brussels, Belgium
- Dr. Miguel Manso Silván, Departamento de Física Aplicada, Facultad de Ciencias, Universidad Autonoma de Madrid, Spain

Selected Publications

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