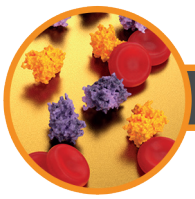


Biocompatibility

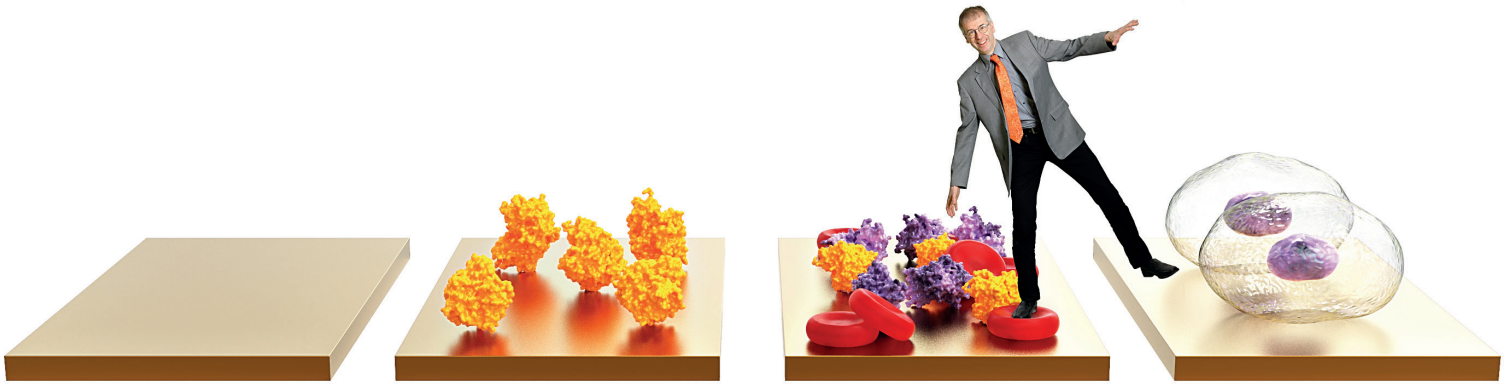
Excellence in Surface Plasmon Resonance

BioNavis

Biocompatibility studies with MP-SPR

Antifouling quality on medical device coatings. Corona formation on new drug delivery nanocarriers.

Unique **Multi-Parametric Surface Plasmon Resonance (MP-SPR)** instruments can extend applicability of SPR also to clinically relevant complex liquids, such as 100 % serum, plasma, urine, bacteria and cells.



Key questions MP-SPR can answer in biocompatibility research:

- How does protein attach to a polymer?
- How does 100% serum interact with a material?
- How does a cleaning process/processing temperature/ageing of the materials affect the material-blood interaction?
- When do material activates the complement system?
- How does shear stress affect to the interaction kinetics?
- What is the swelling dynamics of the material and how do the optical properties change?
- Which surface modification results in the best barrier properties?
- What is the adsorbed mass of blood component?
- What is the minimum thickness of a coating to provide a specific biofunctionality?

www.bionavis.com/biocompatibility

Why choose MP-SPR for biocompatibility measurements?

"MP-SPR allows you to conduct a complete study of your material all the way from characterization, interaction with proteins, serum and plasma up to the interactions with bacteria and cells."

1) Selection of suitable surface model and coating characterization

- Select a surface that best simulates the real surface in contact with biological fluid
- BioNavis provides a wide range of surfaces including for instance Au, SiO_2, TiO_2, PDMS, PS, PC,…
- Optionally, apply your own cleaning and coating process. The coatings can be applied *in situ* (from liquid) or *ex situ* (spin coating, LB, ALD, CVD, ..) to our glass substrates.

2) Interaction of specific proteins

MP-SPR measures molecule and particle adsorption on surface in real-time without labels. Measure affinity, kinetics and true adsorbed mass (excluding artefact signal from water) of blood components such as complement system, thrombin or fibrinogen. High sensitivity of the method allows precise interaction measurements even when interaction is weak.

For multicomponent surfaces, it is recommended to test each component separately as well to see the biggest contribution of adsorption and to enable fine-tuning of the surface composition.

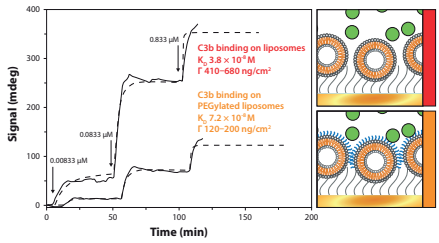


Figure 1. *Binding of complement system component (C3b) on nanocarriers with and without PEG functionalization. Adsorbed mass and affinity was determined. Application Note #152 [Kari 2017]*

3) Interaction of full serum or plasma

In SPR, crude samples usually produce big bulk (solvent) effects. In order to reveal binding, bulk correction is required. In traditional SPR, correction of large bulk signal is challenging and often impossible. The unique optical setup of the MP-SPR instruments enables simultaneous measurement of multiple optical parameters. Real-time cross-correlation of the parameters allows simple in line correction of the interfering bulk signal using the PureKinetics™ feature.

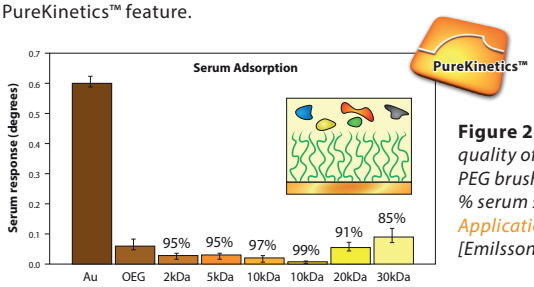


Figure 2. *Antifouling quality of spin-coated PEG brushes in 100 % serum samples. Application Note #149 [Emilsson 2015]*

4) Interaction with bacteria or cells

Once the molecular level is understood, it is possible to move to whole bacteria and cell adhesion studies.

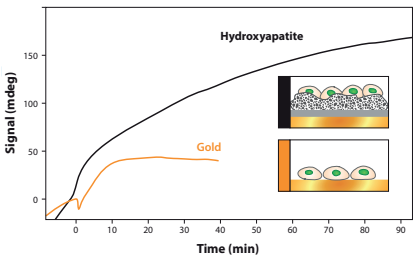


Figure 3. *Ceramic hydroxyapatite (HA) coatings (24 µm thick) were plasma sprayed onto a titanium dioxide (TiO_2) surfaces. Adhesion of human mesenchymal stem cells (AD-MSC) were clearly stronger on HA when compared to gold surfaces. Application Note #154 [Vilardell 2016]*

Recommended MP-SPR Navi™ instruments for biocompatibility measurements:

200 OTSO **400 KONTIO** **210A VASA** **220A NAALI** **420A ILVES**

Further reading:

AN#149	Polymer characterization using MP-SPR- Adsorption studies and layer thickness
AN#152	Drug delivery nanocarrier studies using MP-SPR
AN#154	Real-time cancer cell detection and cell adhesion on implant materials surface
AN#160	Biosensor for bacteria detection from powdered milk

Selected publications:

- Strongly Stretched Protein Resistant Poly(ethylene glycol) Brushes Prepared by Grafting-To (Emilsson et al., ACS Applied Materials & Interfaces, 2015)
- Interaction of Tissue Engineering Substrates with Serum Proteins and Its Influence on Human Primary Endothelial Cells (Mohan et al., Biomacromolecules, 2017)
- Multi-parametric surface plasmon resonance platform for studying liposome-serum interactions and protein corona formation (Kari et al., Drug Deliv. and Transl. Res. 2017)
- Bovine Serum Albumin Adsorption at a Silica Surface Explored by Simulation and Experiment (Kubiak-Ossovska et al., Journal of Physical Chemistry B, 2017)
- Effect of Molecular Architecture on Cell Interactions and Stealth Properties of PEG (Ozer et al., Biomacromolecules, 2017)
- Surface plasmon resonance methodology for monitoring polymerization kinetics and morphology changes of brushes-evaluated with poly(N-isopropylacrylamide) (Emilsson et al., Applied Surface Science, 2017)
- Homogeneous cellulose thin films by regeneration of cellulose xanthate: properties and characterization (Weissl et al., Cellulose, 2017)
- Interaction of Solid Lipid Nanoparticles and Specific Proteins of the Corona Studied by Surface Plasmon Resonance (Di Ianni et al., Journal of Nanomaterials, 2017)
- Synergy between Zwitterionic Polymers and Hyaluronic Acid Enhances Antifouling Performance (Xia et al., Langmuir, 2019)

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