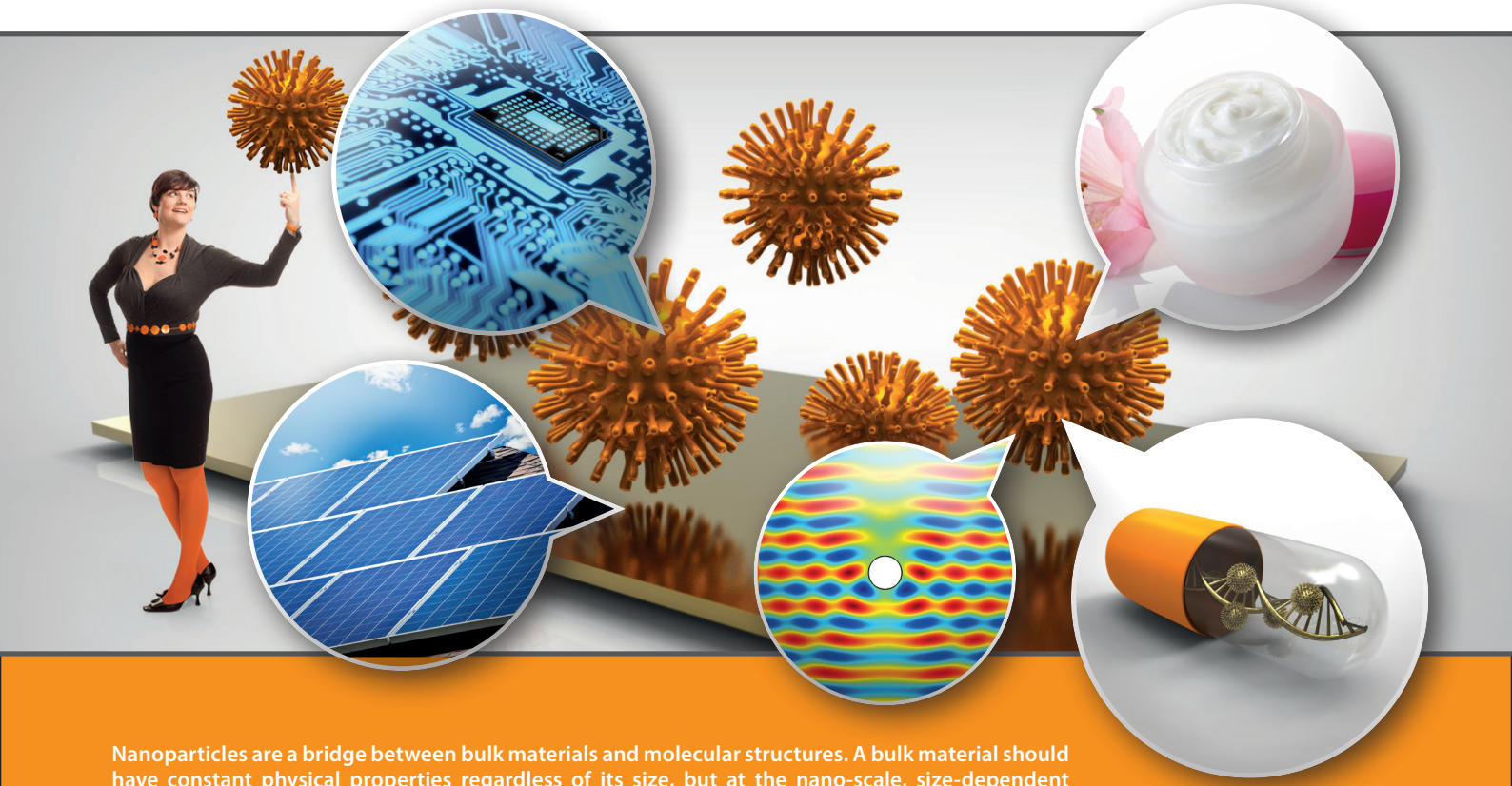
Excellence in Surface Plasmon Resonance

BioNavis

Nanoparticles

From static to dynamic measurements!



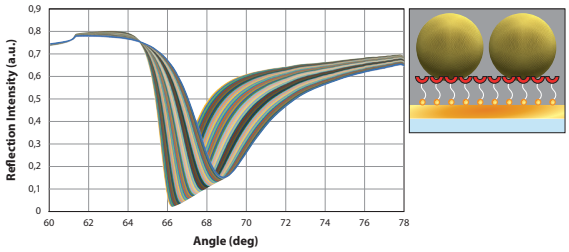
Nanoparticles are a bridge between bulk materials and molecular structures. A bulk material should have constant physical properties regardless of its size, but at the nano-scale, size-dependent properties are often observed. Thus, the properties of materials change as their size approaches the nanoscale, and as the percentage of atoms at the surface of a material becomes significant. MP-SPR provides an insight into the nanoscale phenomena that control the properties of bulk such as emulsion type, barrier quality or quality of adhesion.

Key questions MP-SPR can answer in nanoparticle research:

- What is the adsorption kinetics of nanoparticle X to surface Y?
- What is the release kinetics of material Z from nanoparticle X at different pH?
- How to select the best barrier (non-stick / antireflective / moisture) coating?
- How good (effective) is this plasmonic material?
- How does molecule X interact with nanoparticle Y?
- How thick layer do my nanoparticles form at different flow-rates?
- Which acid removes the layer most effectively?
- What surface modification of nanoparticle X has the best targeting, the best ability to cross lipid membrane and the fastest cell uptake?

www.bionavis.com/nanoparticles

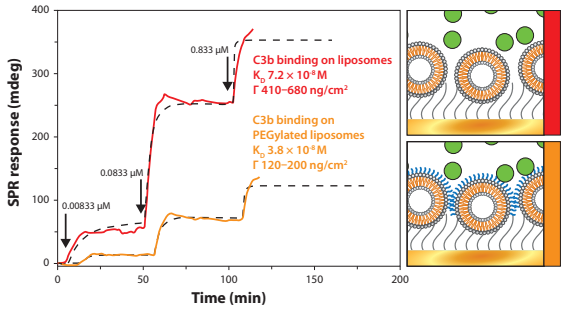
Why choose MP-SPR for nanoparticle characterization?



Adsorption of 50nm gold nanoparticles measured in real-time at 785 nm wavelength using MP-SPR.

From static to dynamic

Most likely, you already have images of your nanoparticles before and after interaction using AFM, SEM, TEM or Raman. Now it is time to find out what happens in between. MP-SPR shows the affinity and kinetics of nanoparticle adsorption, controlled release and internalization in dependence on their surface properties and environmental effects (e.g. pH, temperature, electric potential, light excitation). No sputtering and no vacuum are needed!



The most sensitive instrument for real-time adsorption kinetics on surfaces

Owing to its plasmonic principle, MP-SPR is the most sensitive measurement for kinetics on surfaces. This is important in real-time measurements of nanoparticle adsorption kinetics, swelling and release. Even less than a monolayer of nanoparticles can be detected. MP-SPR is the only platform that allows nanoparticle-material and nanoparticle-lipid interactions, and even nanoparticle internationalization by living cells to be measured.

Thickness and refractive index solved simultaneously

Thanks to our multiple wavelength configuration with scanning angular range of almost 40 degrees, MP-SPR is capable of acquiring enough information to solve thickness and refractive index of the layer simultaneously using LayerSolver™. This is possible even for nanolaminates.

BioNavis has been involved in several industrial projects assessing nanoparticle adsorption onto different surfaces. Resulting nanolayers from 3.5Å (graphene) up to microns were studied for their thickness and optical properties. The MP-SPR method is sensitive to metal thickness, roughness and grain structure, because these properties affect the plasmonic fingerprint that MP-SPR measures.

Compatible with most solvents

Traditional SPR is developed to work in liquid. On the other hand, traditional ellipsometers work the best in air. MP-SPR works in both thanks to its goniometeric configuration. This makes it ideally suited for swelling studies or vapor interactions. 2-channel instruments enable working with many solvents, e.g. acetone, ethanol, isopropanol. Special configuration allows also use of toluene.

Cross-validation with microscopy and modelling is possible

MP-SPR with electrochemistry, fluorescence or another specialty flow-cell allows for validation of measurements *in-situ*. Thanks to its oil-free operation, the same sample can be measured *ex-situ* with AFM or other techniques. Results from MP-SPR are absolute and therefore can be directly related to physical properties, and validated by established theoretical models. They can be confirmed also analytically.

Recommended MP-SPR Navi™ instruments for nanoparticle characterization:

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

Further reading:

AN#158	Predicting cellulose nanocrystals dispersibility using MP-SPR
AN#156	Nanoparticle uptake by cells
AN#152	Drug delivery nanocarrier studies using MP-SPR
AN#151	MP-SPR measurements of soft and hard corona formation on nanoparticle in 100% serum
AN#146	Graphene monolayer characterization
AN#140	Self-assembly of gold nanoparticles measured MP-SPR
AN#128	Determining thickness and refractive index of dielectric films using MP-SPR

Selected publications:

Adsorption and lubricating properties of HFBII hydrophobins and diblock copolymer poly(methyl methacrylate-b-sodium acrylate) additives in water-lubricated copper vs. a-C:H contacts,
(Hakala et al., Tribology International, 2015)

Self-assembly of gold nanoparticles
(Vikholm-Lundin et al., Applied Surface Science, 2016)

Interaction of 100% serum and corona formation on drug delivery nanoparticles (Kari et al., Drug Delivery and Translational Research, 2016)

Real-time monitoring of nanoparticle uptake by living cells
(Suutari et al., Small 2016)

Size and concentration of extracellular vesicles
(Rupert et al., Analytical Chemistry, 2016)

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