Excellence in Surface Plasmon Resonance

BioNavis

Thin solid films

# Ångström resolution for your coatings!


Thin solid films are typically applied as coatings (nanolayers) to provide functionality to everyday products from electronics and batteries, through solar cells and packaging to automotive components and door knobs. Over recent years, the manufacturing processes have improved tremendously saving amount of material needed to form a uniform coating. Therefore, thinner and thinner layers of coatings have to be analyzed and that often hits the limit of traditional methods. BioNavis applies plasmonics to provide reliable measurement of thickness and refractive index of nanolayers, their plasmonic properties and surface interactions.

## Key questions MP-SPR can answer in thin solid film research:

- How to select the best barrier (non-stick / antireflective / moisture) coating?
- How thin can the nanolayer be and still provide desired functionality?
- What is the quality of the coating?
- What are the ideal pH, electric potential and flow-rate conditions for the process?
- How does the layer swell in contact with gas / moisture / solvent?
- How good is the plasmonics of metal layer?
- Which solvent is the most effective?

**www.bionavis.com/thin-solid-films**

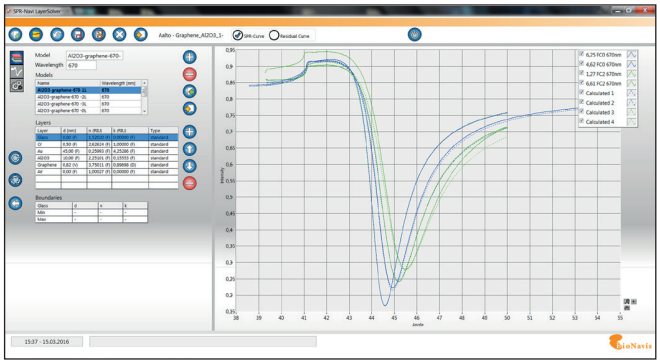
# Why choose MP-SPR for characterization of thin solid films?

## Ultrathin films from thickness of a few Ångströms

BioNavis has been involved in industrial projects where atomic layer deposition (ALD) and chemical vapor deposition (CVD) were used to produce ultrathin layers of graphene, metals and metal oxides. Resulting nanolayers from 3.5 Å (graphene) up to hundred nanometers were studied for their thickness, optical properties and plasmonics. The MP-SPR method is sensitive to metal thickness, roughness and grain structure, because these properties affect the plasmonic fingerprint that MP-SPR measures.

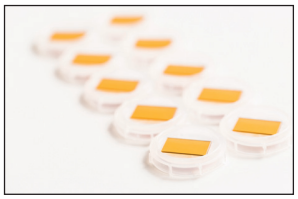
## Thickness and refractive index solved simultaneously

Thanks to our multiple wavelength configuration with scanning angular range of nearly 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.



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

Due to its plasmonic principle, MP-SPR is the most sensitive measurement for kinetics on surfaces. This is important in real-time measurements of molecules and nanoparticles adsorption kinetics, swelling and release.



## Air, water and solvent compatible

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 the goniometeric configuration. Besides water, 2-channel instruments enable working with many solvents, e.g. ethanol, acetone, isopropanol. Special prism configuration allows also measurements in toluene.

## Cross-validation with microscopy and modelling is possible

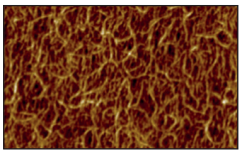
MP-SPR with electrochemistry, fluorescence or another specialty flow-cell allows for validation of measurements *in-situ*.

Thanks to its oil-free operation, the same sample can be measured *ex-situ* with AFM, SEM or other techniques.

Results from MP-SPR are absolute and therefore can be directly related to physical properties, validated by established theoretical models, and can be confirmed also analytically.

## MP-SPR measurements do not require vacuum

MP-SPR measurements can be performed at different pH, temperature (15 to 45 °C), electric potential. The measurements do not require vacuum.



## Recommended MP-SPR Navi™ instrument for thin solid film characterization:

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

## Further reading:

| | |
|---|---|
| **AN#153** | Metal-organic Framework (MOF) Characterization using MP-SPR |
| **AN#146** | Characterizing single-sheet CVD prepared graphene |
| **AN#142** | Real-Time Monitoring of Metal Stripping and Deposition with EC-MP-SPR |
| **AN#140** | Self-assembly of gold nanoparticles measured with MP-SPR |
| **AN#133** | Characterization of atomic layer deposited metal films and nanolaminates |
| **AN#128** | Determining thickness and refractive index of dielectric layers using MP-SPR |
| **AN#127** | Determining thickness and refractive index of metal and metal like ultrathin films using MP-SPR |

**Selected publications:**


Thickness and refractive index characterization by MP-SPR (Granqvist et al., Langmuir, 2013)

Marine anti-biofouling coatings (Xu et al., ACS Applied Materials & Interfaces, 2014)

Biolubrication additives on copper and DLC (Hakala et al., Tribology International, 2015)

CVD-prepared graphene characterization (Jussila et al., Optica, 2016)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