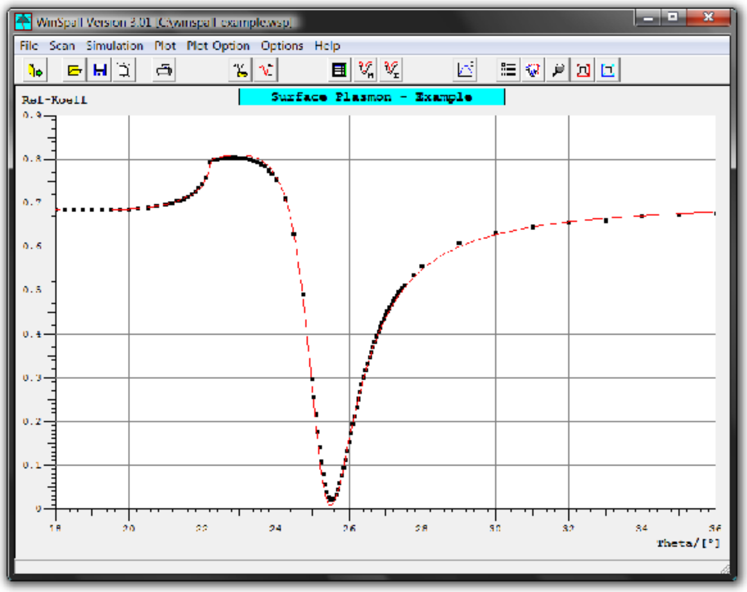
EXPLORE THE POWER OF EVANESCENT FIELDS

Surface Plasmon Resonance
Features of a SPR reflectivity curve

Res-Tec tutorial #1

What influences the features of a surface plasmon resonance curve?



This little tutorial helps you understand the most important features of a SPR curve. We determine the features of such a curve and discuss all parameters that influence the "looks" of this curve. This will help you understand the data you measure.

By the way: The above plots were generated using WinSpall. Learn more about this SPR simulation software in our WinSpall tutorial (see www.res-tec.de).

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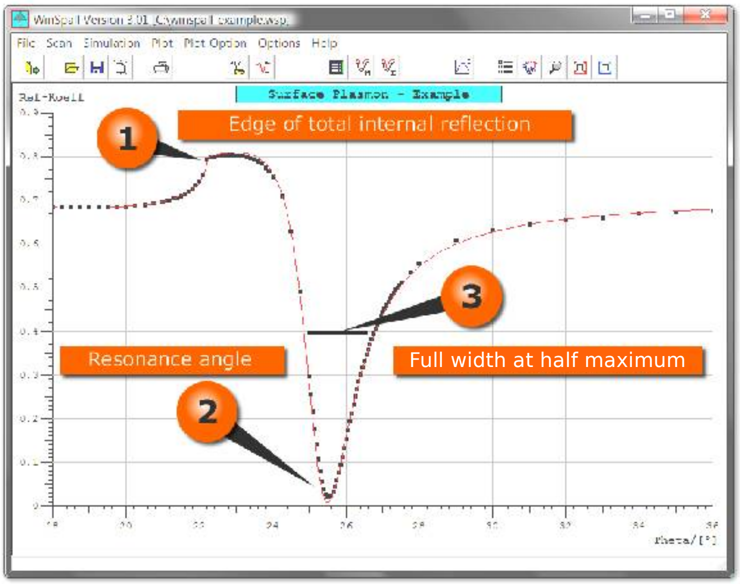
An overview



As we look at the plasmon resonance we can determine three different areas of interest:

1. The edge of total internal reflection. We will learn that this feature is not just there for some strange physical reasons: it is also an important feature to validate our measurement.
2. The resonance angle (or “the plasmon” itself). The actual angular position but also the depth will be important to learn something from “the plasmon”.
3. The full width at half maximum. Optical constants do matter. We will see how.

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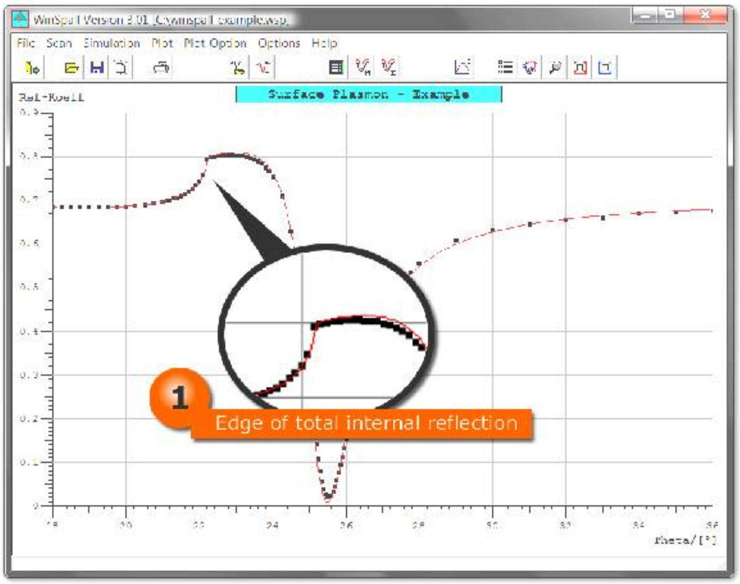
The edge of total internal reflection

The **edge of total internal reflection, Θ_c**. The position, i.e. the angle at which total reflection is found depends solely on the difference of the dielectric constants of the two infinite media – the prism and the cover medium, typically air or water. These values are known and, hence, Θ_c is fixed for a given system.



For this reason, this angle is an important value to validate correct sample alignment. Note, we sometimes try to measure very minute changes of the minimum position of the plasmon. It is important to crosscheck these small differences with neutral feature like Θ_c. We recommend to always include this region in any SPR experiment.

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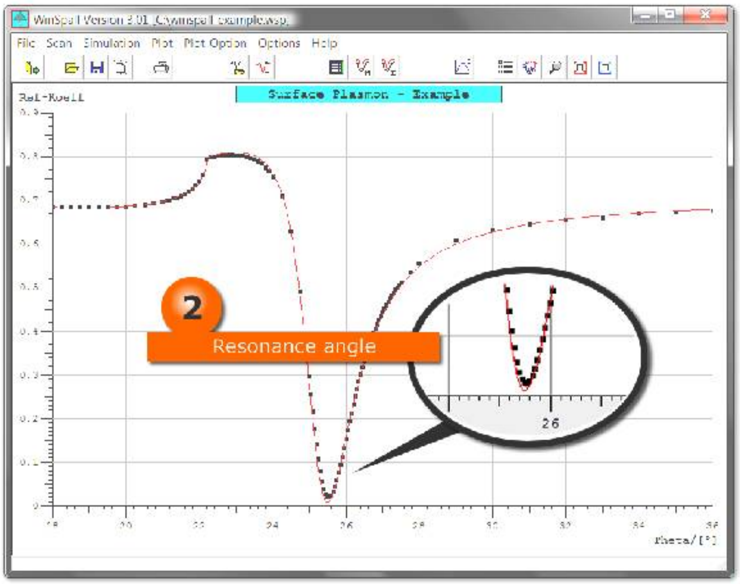
The resonance angle

The **resonance angle**. This is “our plasmon” – the quantity, we want to determine. In the absence of any film, its angular position is given by the optical constants of the prism, the surrounding medium, and the type of metal. Measuring the plasmon of such a “blank substrate” is important to determine exactly these parameters and use them later on for the analysis of the plasmon measured after layer deposition. The modeling of these reflectivity curves is then done using the parameters of the blank fit and adjusting only film related layer parameters.



Note, the plasmon must not always touch the zero line. This depends quite critically on the thickness of the metal layer. The closer this thickness is to 50 nm the “deeper” will the dip be.

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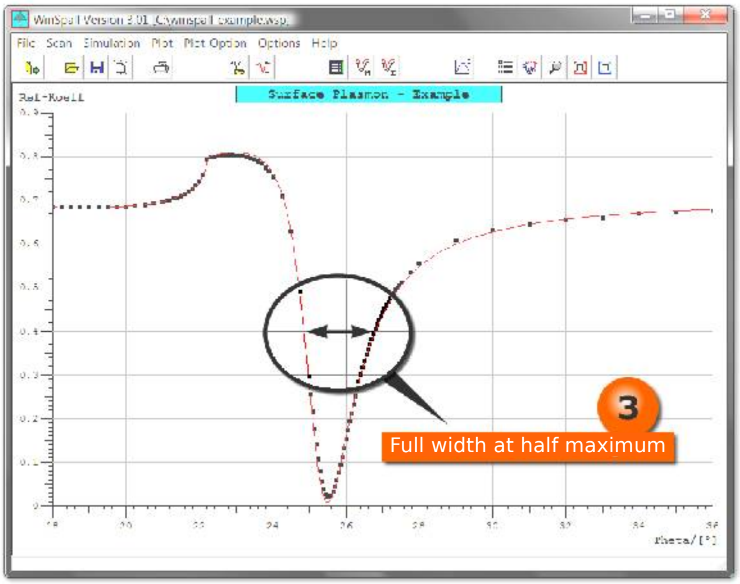
Full width at half maximum



The **full width at half maximum**. The “width of the plasmon” of a blank substrate depends on the imaginary part of the dielectric constant of the metal. This is why “silver plasmons” are much sharper, narrower than “gold plasmons”. For the blank measurement it is appropriate to adjust e'' such that the width of the model curve describes the measured data.

Most layers – if generated from organic molecules – do not absorb light at the typical SPR wavelength (red laser) and $\varepsilon''=0$. Any broadening of the resonance curve is then typically caused by heterogeneities. In such cases the model calculation should capture the correct angular position of the plasmon and neglect the broadening.

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