Dipl.-Ing. (FH) Thomas Fuchs
Engineer's Office for Applied Spectroscopy
Ingenieurbüro für Angewandte Spektrometrie

TranSpec

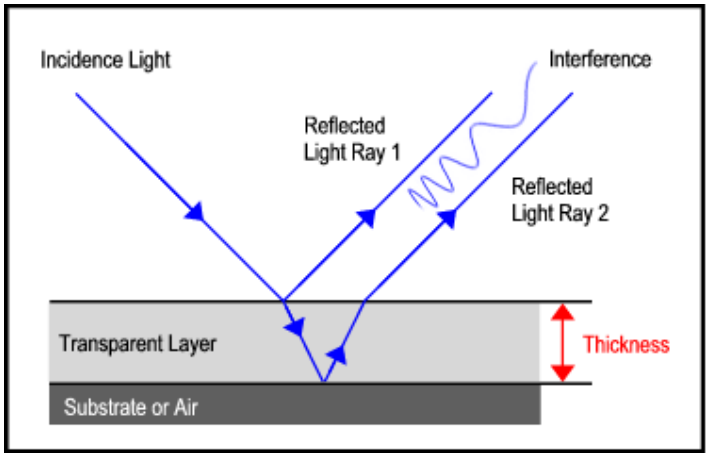
Film Thickness Measurement

Application Note

Measurement Method Principles

A commonly well-known effect, which occurs for example with soap bubbles or on a thin oil film on water, is used here for the determination of the film thickness. You can see many colors, which change according to the layer thickness, for example, when the soap bubble is blown up.

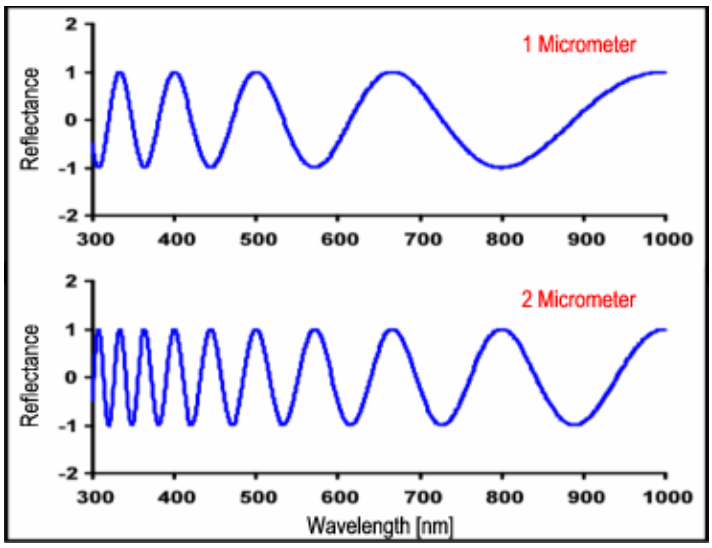
These "colors at thin layers" are based on the interference phenomenon: the super-position of light waves which have been reflected at the front and back side of the layer (in other words: at two boundaries with different optical densities).



The interference model

The undisturbed superposition of the two reflected light rays 1 and 2 leads to periodical amplification and extinction in the reflectance spectrum of a continuum light source, like from a halogen spectral lamp as a pseudo white-light source.

Since the superposition of the two reflected light rays is not purely additively, an interference spectrum occurs. The chart on top shows an exemplary interference spectrum of a 1 µm layer and below of a 2 µm layer.



Examples of interference spectra

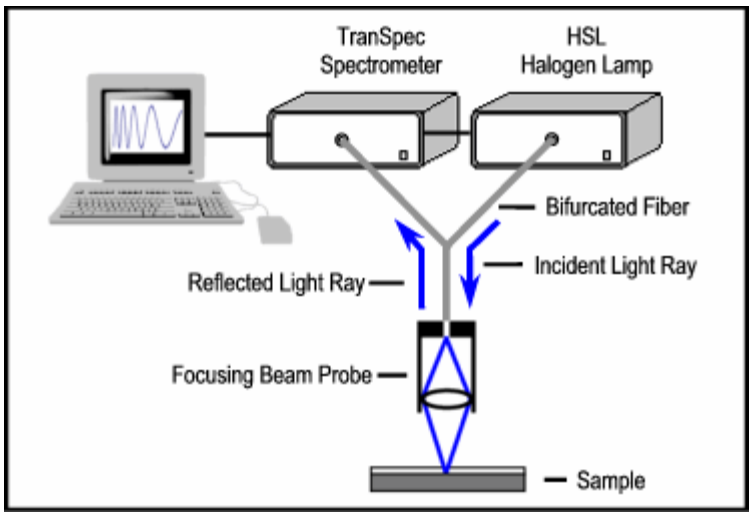
Continued on next page ►

ZIP & City: 73430 Aalen - Germany
Street: Bischof-Fischer-Str. 108
Fon: +49 - 7361 - 97 53 28 0
Fax: +49 - 7361 - 97 53 28 5
Web: www.applied-spectroscopy.com
Email: sales@applied-spectroscopy.com

Dipl.-Ing. (FH) Thomas Fuchs
Engineer's Office for Applied Spectroscopy
Ingenieurbüro für Angewandte Spektrometrie

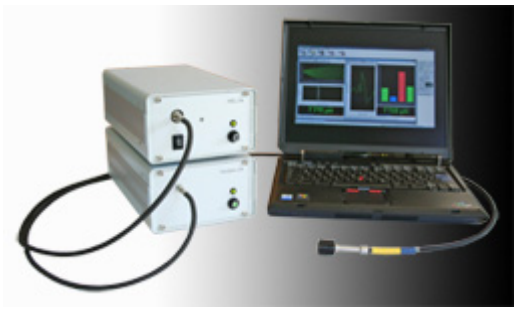
Film Thickness Gauges and Measurement Setup

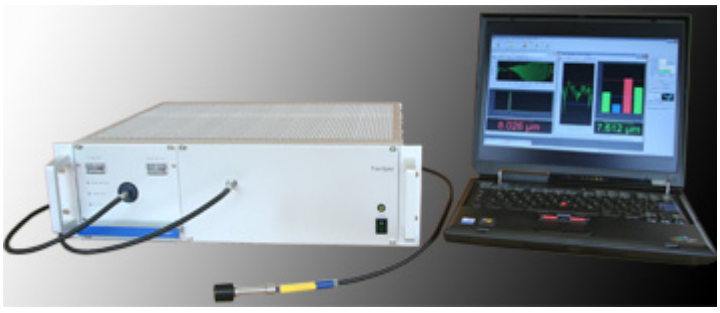
The interference spectra of thin transparent or semi-transparent layers are measured and analyzed by our TranSpec Lite film thickness gauges or TranSpec process spectrometer with integrated spectral lamp, as shown in the following schematic figure:



Schematic gauge setup

The sample is illuminated through a bifurcated fiber optics, which is connected to the spectrometer and a halogen lamp as pseudo white-light source. The reflected interference spectrum is guided back to the spectrometer, where it is analyzed and the thickness is computed.





The picture on the left shows our TranSpec Lite thickness gauge mainly used for lab or manually performed measurements. At the right is a TranSpec process spectrometer with integrated deuterium/ halogen lamp in standard 19-inch chassis used for in-line measurement tasks.

Continued on next page ►

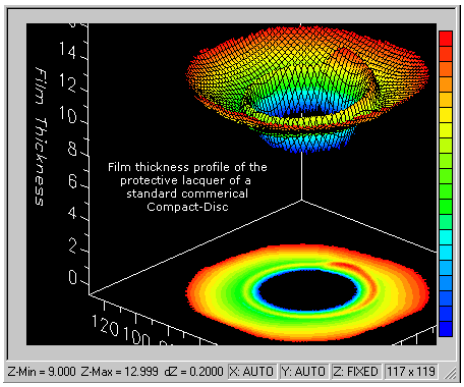
ZIP & City: 73430 Aalen - Germany
Street: Bischof-Fischer-Str. 108
Fon: +49 - 7361 - 97 53 28 0
Fax: +49 - 7361 - 97 53 28 5
Web: www.applied-spectroscopy.com
Email: sales@applied-spectroscopy.com

Dipl.-Ing. (FH) Thomas Fuchs
Engineer's Office for Applied Spectroscopy
Ingenieurbüro für Angewandte Spektrometrie

TranSpec

Application Examples

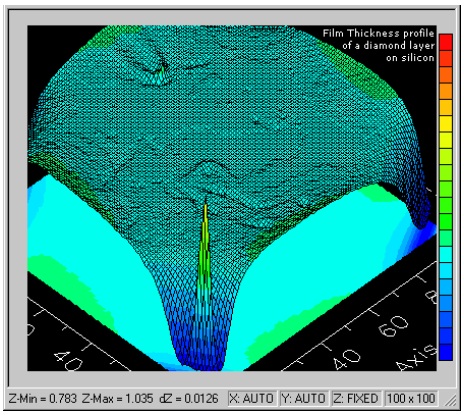
Protective Lacquer Coatings on Compact Discs or on Automobile Headlights



Film thickness measurement of dry and wet coatings, including the possibility of simultaneous two-layer control. Our technology and gauges are used by the world's leading manufacturers of automobile headlights and Compact Discs.

The chart shows a 3D film thickness profile of a protective lacquer of a standard commercial Compact-Disc in the thickness range of 9 to 13 µm. Note the spot where at the liquid lacquer has been dropped during the spin coating!

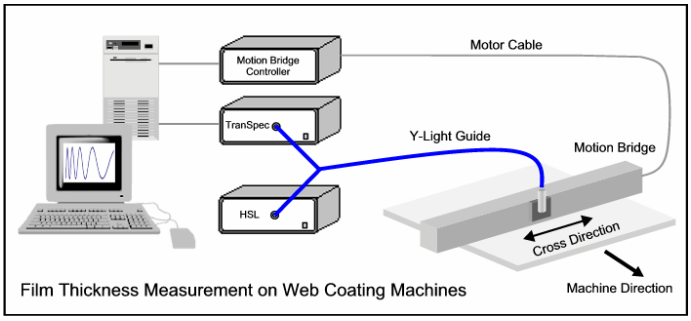
Vapor Deposition Layers and Photo-Resist Coatings



The highly precise technology of our thickness gauges determines the film thickness of even sub-micron layer structures.

The chart shows a 3D film thickness profile of a 10 mm² diamond layer on a silicon wafer in the thickness range of 800 to 1000 nanometers. Each bar color maps a thickness range of only 12 nanometers. Note the microstructures on the plateau of the diamond layer!

In-line Thickness Measurement on Web Coater



The film thickness profile of web coated foils can be precisely determined using a scanning bridge and our TranSpec gauges, which permits intermediate feedback for your process control.

The figure shows a schematic gauge setup on a web coating or foil machine. The actual sensor is mounted on a linear motion bridge and continuously moved forwards and backwards in cross-direction to the coating machine.

ZIP & City: 73430 Aalen - Germany
Street: Bischof-Fischer-Str. 108
Fon: +49 - 7361 - 97 53 28 0
Fax: +49 - 7361 - 97 53 28 5
Web: www.applied-spectroscopy.com
Email: sales@applied-spectroscopy.com