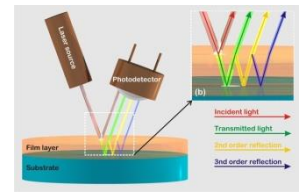


ThetaMetrisis APPLICATION NOTE #046

Measurements of HardCoat and Anti-Fogging coatings on automotive headlights



Introduction:

Headlights on modern day vehicles are made from PolyCarbonate (PC), a material that despite its versatility is not quite suitable for long term exposure in UV radiation which due to photodegradation will result in discolour to yellow and cracking. To overcome such effects, these headlights are usually coated with two layers: one HardCoat (HC) layer to withstand scratches and an Anti-Fogging (AF) layer to ensure the proper operation under a wide range of conditions. It is important that the two coatings cover all headlight areas and have sufficient thickness. Thus, the measurement of the HC and AF thicknesses by a fast and non-destructive way is crucial for the long-term operation of the headlight. In the present application note, the use of a standard FR-tool with a ContactProbe module is demonstrated in the accurate, fast and non-destructive measurement of AF and HC layers at any point of the headlight.

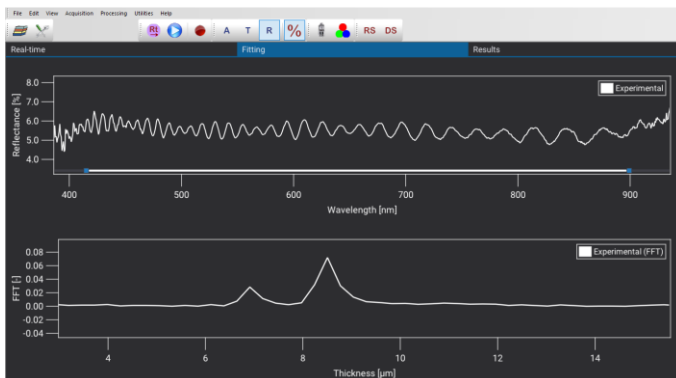
Means & Methods:

For the characterization of the coatings on automotive headlights a standard **FR-pRo VIS/NIR tool operating in the 380-1000nm** along with the was employed. This configuration, allows coating thickness measurements of in the **20nm-90µm range**. The use of ContactProbe-ST allows for constant distance between the reflection probe's tip and the curved surface of the headlight under characterization.



Results:

The characterization of the inner and outer coatings was done through reflectance measurements by applying the ContactProbe-ST on the external surface of the headlight. The powerful FFT algorithms embedded in FR-Monitor software allow for the simultaneous determination of the thicknesses of both coatings (exterior HC and interior AF). A typical measurement and FFT analysis is illustrated in the figure below. The measured thicknesses were: HC-thickness=6.9µm and AF-thickness=1.6µm. The results of the statistical analysis over 12 measurements at various points on the headlight are illustrated in the table below:



	Mean thickness value	st. dev
HardCoat (outer coating)	6.9µm	0.3µm
Anti-Fogging (inner coating)	1.6µm	= 0.2µm

Figure 1: (Left) FR-Monitor screenshot: In the top figure, the reflectance spectrum as it is collected by the ContactProbe-ST module is illustrated. In the bottom figure the FFT spectrum is illustrated where the two peaks correspond to the thicknesses of the two coatings. (Right) Mean thickness value and standard deviation values for both measurements.

Conclusions:

The thicknesses of the HardCoat and AntiFogging layers of PolyCarbonate automotive headlights was demonstrated by the use of a standard FR-pRo VIS/NIR and a ContactProbe-ST.