



NIR APPLICATION NOTE NIR-092

Quality Control of PVC foils

Easy and robust determination of PVDC layer thickness

PVC (polyvinyl chloride) foils with a PVDC (polyvinylidene chloride) coating are often used for high performance packaging films like pharmaceutical blister packs or in food packaging. In multi-layer blister films, the PVC serves as the thermoformable backbone structure, whereas the PVDC coating acts as a barrier against moisture and oxygen. The Water Vapor Transmission Rate (WVTR) and Oxygen Transmission Rate (OTR) are influenced by the composition and the thickness of the coating.

A fast way to monitor PVDC coating thickness is with near-infrared spectroscopy. Results are provided **in a few seconds**, indicating when adjustments in the polymer production process are necessary.

EXPERIMENTAL EQUIPMENT

Several 250 μm PVC foils coated with a PVDC layer of varying thickness (40 g/m^2 , 60 g/m^2 , 90 g/m^2) were measured on the DS2500 Solid Analyzer. The measurements were carried out in transflection mode using the NIRS gold diffuse reflector with 1 mm pathlength. This ensures that the spectral pathlength is constant while enhancing the spectral signal. The Metrohm software package Vision Air Complete was used for all data acquisition and prediction model development.

Table 1. Hardware and software equipment overview

Equipment	Metrohm number
NIRS DS2500 Solid Analyzer	2.922.0010
Vision Air 2.0 Complete	6.6072.208
NIRS gold diffuse reflector, 1 mm	6.7420.000
NIRS mini sample cup	6.7402.030



Figure 1. DS2500 Solid Analyzer

RESULT

All 68 measured Vis-NIR spectra (Figure 2) were used to create a prediction model for quantification of PVDC layer thickness. The quality of the prediction model was evaluated using correlation diagrams, which display a very high correlation between Vis-NIR prediction and the reference values. The respective figures of merit (FOM) display the expected precision of a prediction during routine analysis.

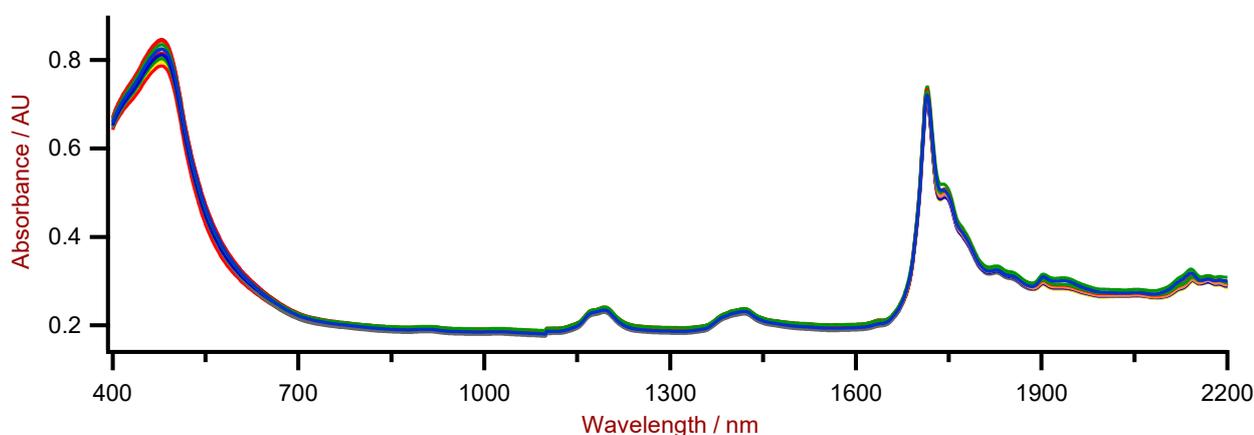
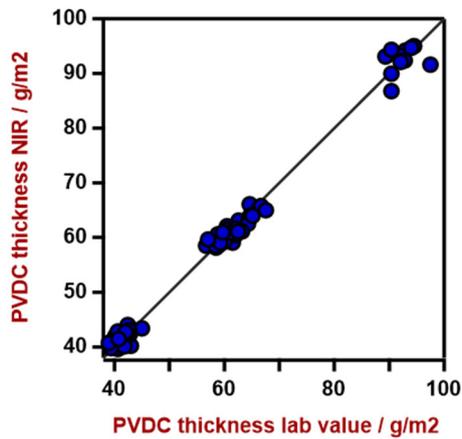


Figure 2. Vis-NIR spectra of PVC foils with different PVDC layer thicknesses measured on a DS2500 Solid Analyzer.

RESULT LAYER THICKNESS



Figures of Merit	Value
R ²	0.992
Standard Error of Calibration	1.7 g/m ²
Standard Error of Cross-Validation	1.9 g/m ²

Figure 3. Correlation diagram and the respective figures of merit for the prediction of PVDC layer thickness using a DS2500 Solid Analyzer.

CONCLUSION

This application note demonstrates the feasibility of differentiating PVC foils coated with different PVDC layer thickness (40, 60, 90 g/m² PVDC on 250 µm PVC foils). The thickness of the PVDC layer could be successfully determined with NIR spectroscopy with

an average difference with respect to the reference data of 2%. Vis-NIR spectroscopy enables a fast determination without any sample preparation, and therefore represents a suitable method to measure PVDC layer thickness.

Analytes: Physical parameters; Other
Matrix: Polymers, resins
Industry: Polymers & plastics
Standards: ASTM E1655