Application Note AN-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.

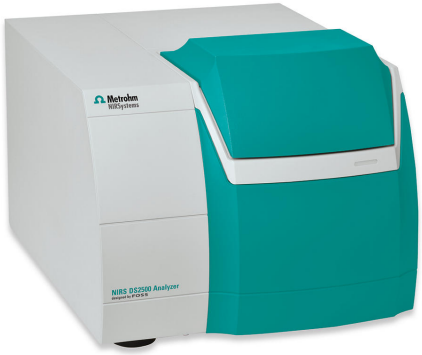


**Figure 1.** DS2500 Solid Analyzer

**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 |

## 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.

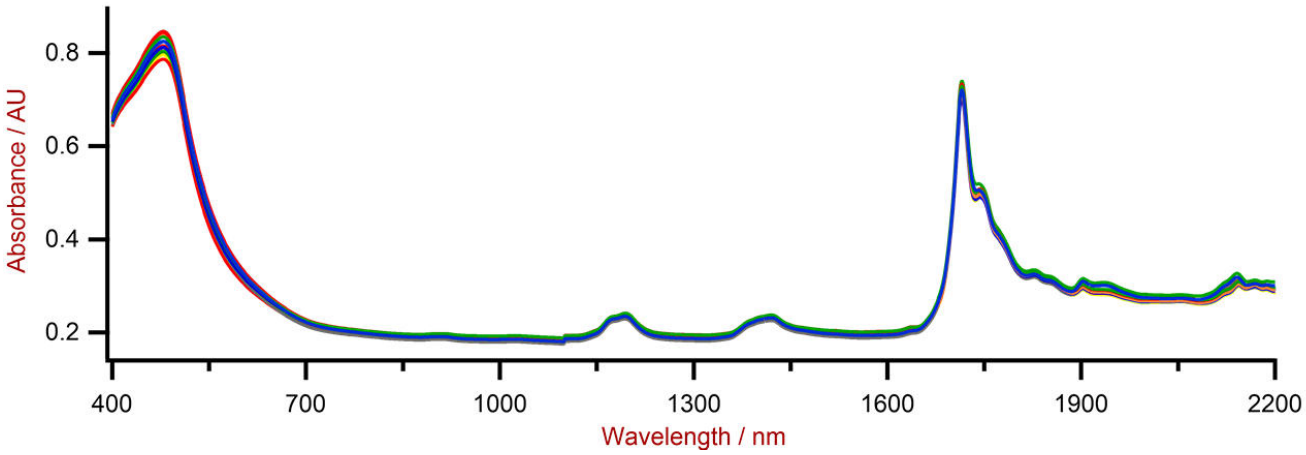


**Figure 2.** Vis-NIR spectra of PVC foils with different PVDC layer thicknesses measured on a DS2500 Solid Analyzer.

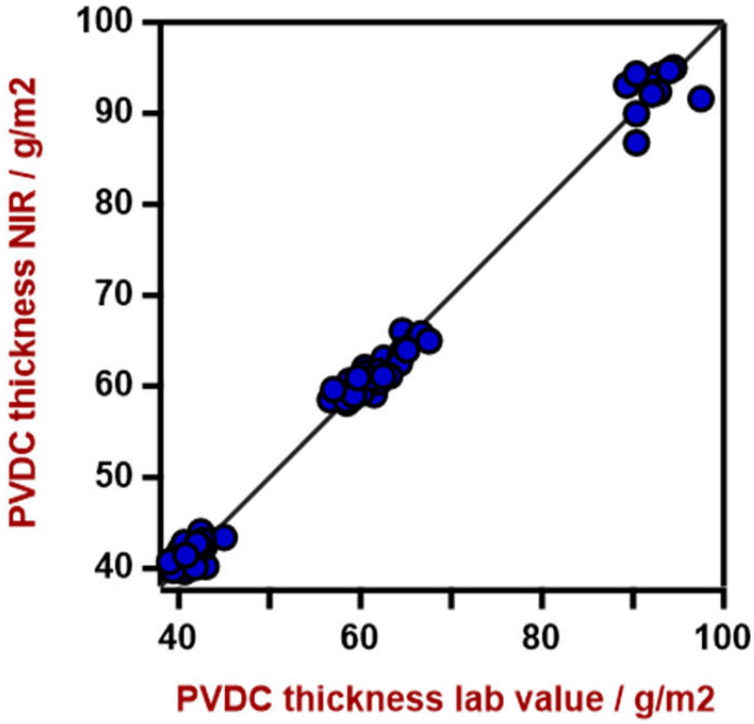


**Figure 3.** Correlation diagram for the prediction of PVDC layer thickness using a DS2500 Solid Analyzer.

**Table 2.** Figures of merit for the prediction of PVDC layer thickness using a DS2500 Solid Analyzer.

| 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/$m_2$ |

## CONCLUSION

This application note demonstrates the feasibility of differentiating PVC foils coated with different PVDC layer thickness (40, 60, 90 g/$m^2$ 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.

## CONTACT

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