



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  $\mu\text{m}$  PVC foils coated with a PVDC layer of varying thickness (40  $\text{g}/\text{m}^2$ , 60  $\text{g}/\text{m}^2$ , 90  $\text{g}/\text{m}^2$ ) were measured on the DS2500 Solid Analyzer. The measurements were carried out in transfection 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

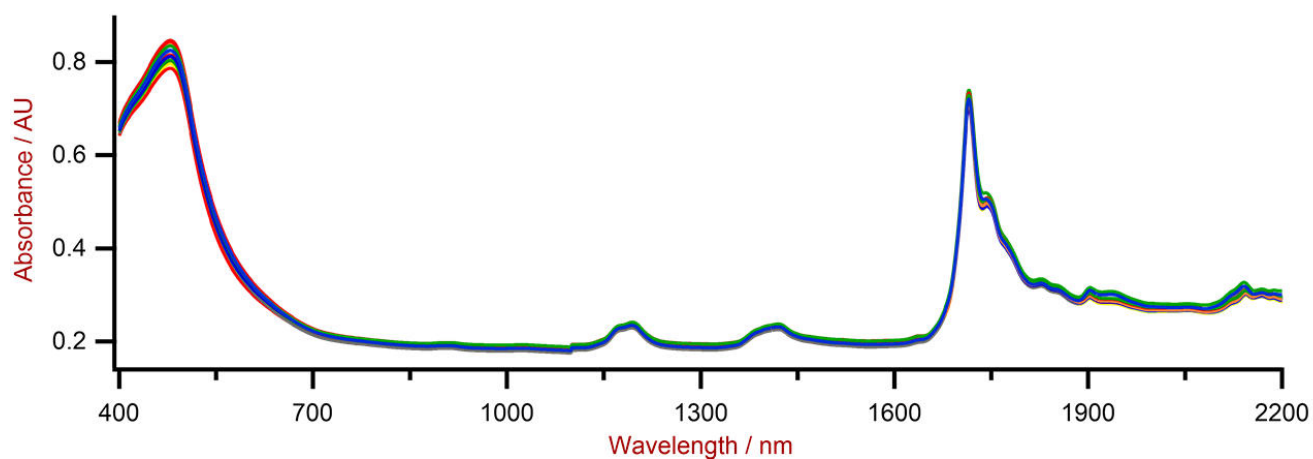
**Table 1.** Hardware and software equipment overview

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

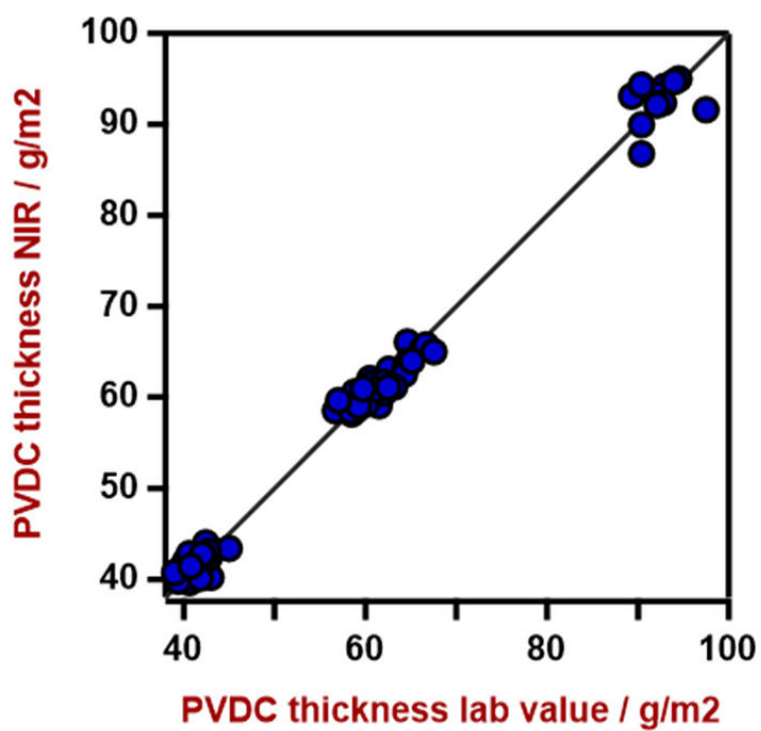
## RESULT

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 <sup>2</sup>
Standard error of cross-validation	1.9 g/m <sup>2</sup>

## CONCLUSION

This application note demonstrates the feasibility of differentiating PVC foils coated with different PVDC layer thickness (40, 60, 90 g/m<sup>2</sup> 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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### DS2500 Solid Analyzer

固的近外光,用于生境和室中的量。

DS2500 分析是的活解决方案,用于整个生程中的固体、乳膏和液体行常分析。其固的使 DS2500 Analyzer 分析不受灰、湿度、振和温度波影,因此非常用于在劣的生境中使用。

DS2500 涵盖了从 400 到 2500 nm 的整个光范,并能在不到一分内提供准和可再的果。DS2500 Analyzer 足制行的要求,并由于操作便而能助用完成其日常工作任。

由于与匹配,附件可以承受任何具有挑性的品型,例如:粒料之的粗粒固体或乳膏之的半固体品,可得果。量固体的候,使用 MultiSample Cup 可以提高生率,可以自批批量多 9 个品。



## Vision Air 2.0 Complete

Vision Air – 通用的光分析件。

Vision Air Complete 是用于管范境的先易用的件解决方案。

Vision Air 点一:

- 便捷的件用和配的用界面保了直的操作方式
- 操作程的建与方式
- SQL 数据,可安全且地管理数据

Vision Air Complete (66072208) 版本包含所有用于可近外光分析量保程的用:

- 器和数据管理用
- 方法用
- 常分析用

其它 Vision Air Complete 解决方案:

- 66072207 (Vision Air Network Complete)
- 66072209 (Vision Air Pharma Complete)
- 66072210 (Vision Air Pharma Network Complete)



## NIRS 1 mm

液体行透射反射量的金反射器。可与下列合使用:

- NIRS DS2500 Analyzer(号:2.922.0010)
- NIRS XDS MasterLab Analyzer(号:2.921.1310)
- NIRS XDS MultiVial Analyzer(号:2.921.1120)
- NIRS XDS RapidContent Analyzer(号:2.921.1110)
- NIRS XDS RapidContent Analyzer - Solids(号:2.921.1210)



### NIRS 10 100

用于粉末和粒反射光采集的小号品容器。品容器可用一次性盖封,可避免品失,并使粉末及粒在品容器中均匀分布。

此品瓶可与下列器一同使用:

- NIRS DS2500 Analyzer(号:2.922.0010)
- NIRS XDS MasterLab Analyzer(号:2.921.1310)
- NIRS XDS MultiVial Analyzer(号:2.921.1120)
- NIRS XDS RapidContent Analyzer(号:2.921.1110)
- NIRS XDS RapidContent Analyzer - Solids(号:2.921.1210)