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.

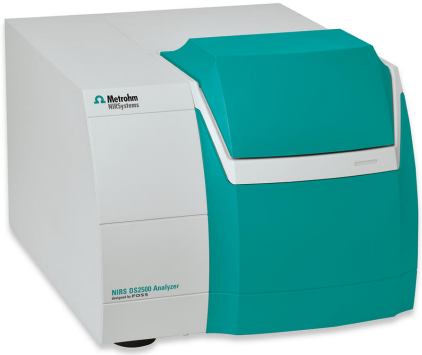

Figure 1. DS2500 Solid Analyzer

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.

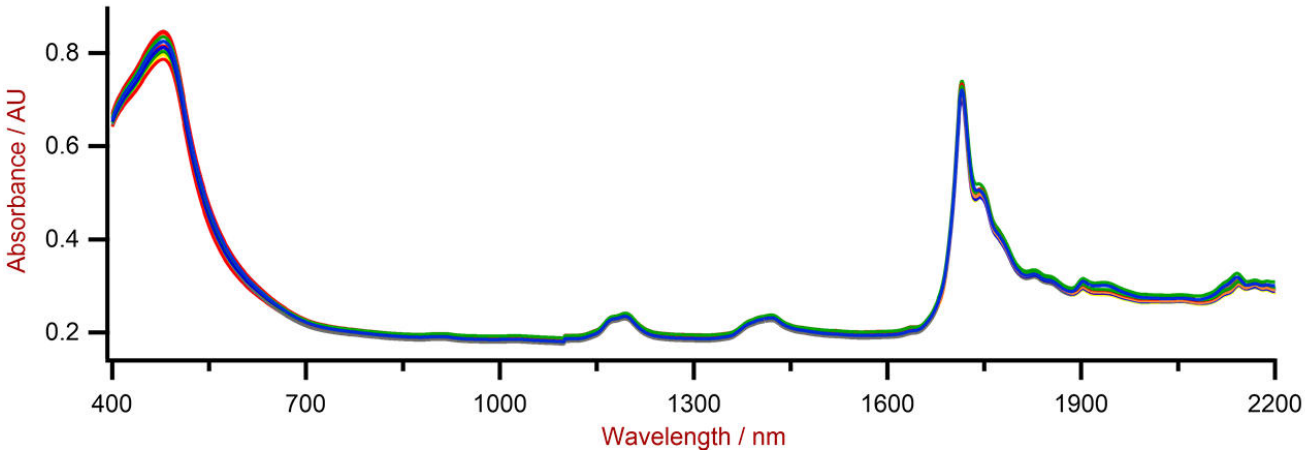

Figure 2. Vis-NIR spectra of PVC foils with different PVDC layer thicknesses measured on a DS2500 Solid Analyzer.

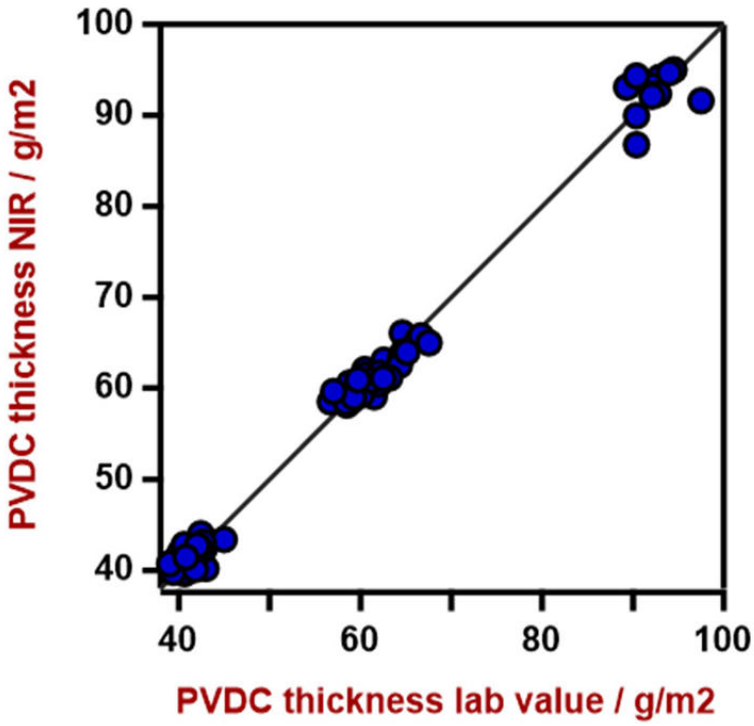

Figure 3. Correlation diagram for the prediction of PVDC layer thickness using a DS2500 Solid Analyzer.

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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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、振和温度波的影,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,可以自批量量多 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)