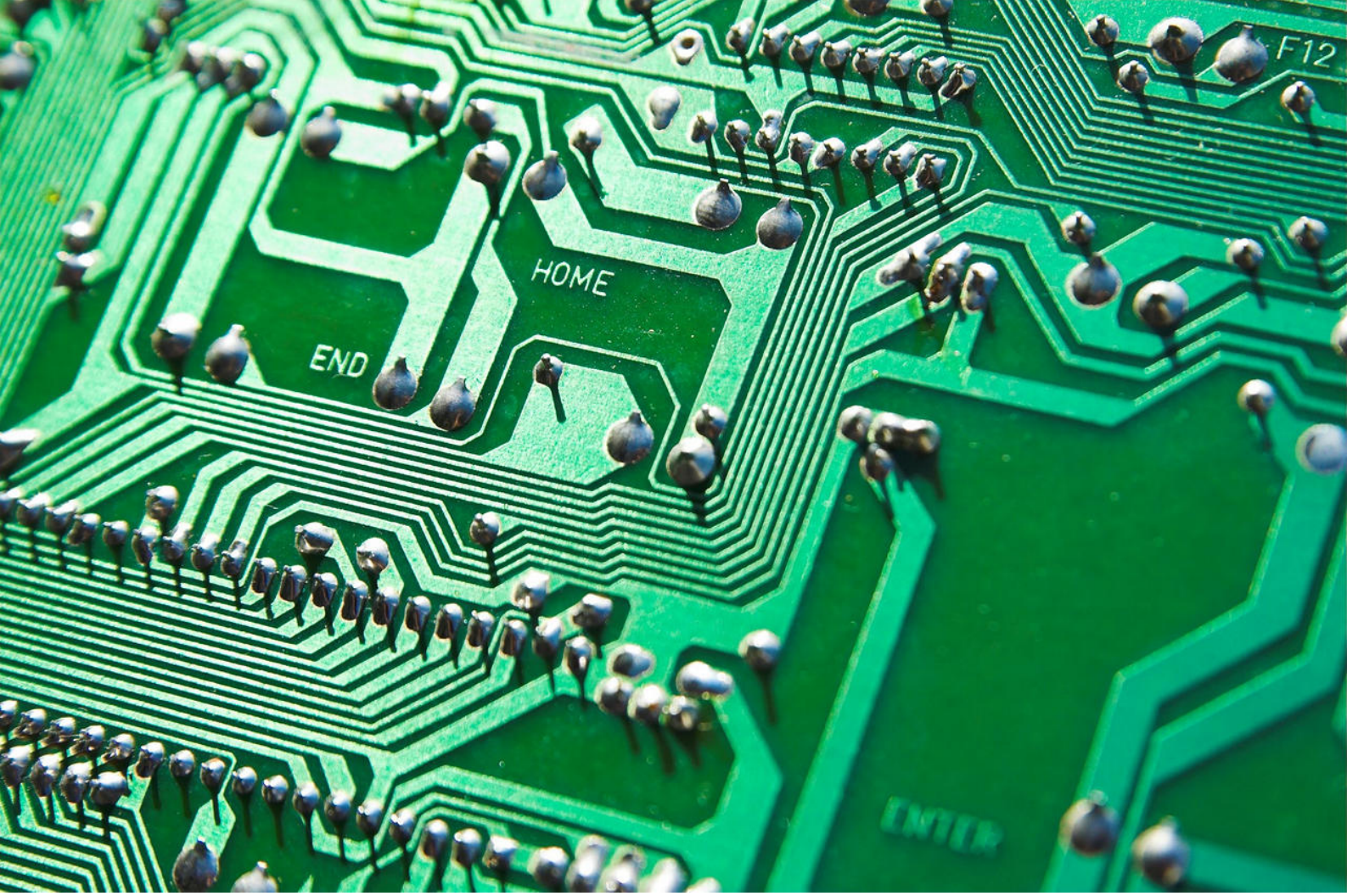

Application Note AN-NIR-089

层压板的质量控制

Improved PCB production testing with NIR spectroscopy

In the semiconductor industry, thermoset resins combined with fabric or paper are used as an intermediate layer between substrates of printed circuit boards (PCB). These polymer-based sheets (laminates) are chosen depending on thickness and their thermomechanical and electrical characteristics. Important quality parameters are tensile and shear strength, the glass transition temperature, expansion coefficient, and dielectric constant.

Near infrared spectroscopy (NIRS) is a fast, non-destructive and easy-to-use analytical method which allows the measurement of multiple parameters in less than a minute. The following Application Note describes the determination of the transition time of PCB laminates by NIRS, a parameter correlating with the thickness, glass transition temperature, and tensile strength of the material.

EXPERIMENTAL EQUIPMENT

520 spectra of samples were collected using a Metrohm DS2500 Solid Analyzer and the Vision Air Complete spectroscopy software. The laboratory values for the transition time were determined by melting the samples, and values between 60 and 126 seconds were obtained. The data set consisting of spectra and lab values was split into a calibration and validation set (1:1). Outlier detection was performed on pre-processed spectra (2nd derivative and SNV) using a maximum distance algorithm. The NIR prediction model was created with the equipment described in Table 1 and validated using the validation set.

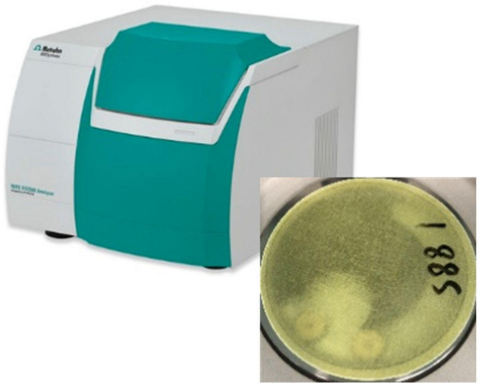

Figure 1. DS2500 Solid Analyzer and a polymer sheet resin.

Table 1. Hardware and software equipment overview

Equipment	Metrohm number
DS2500 Solid Analyzer	2.922.0010
DS2500 large sample cup	6.7402.050
Vision Air 2.0 Complete	6.6072.208

RESULTS

The obtained correlation graph displays a high correlation (R^2 = 0.95) between transition times predicted by NIR and the primary lab method (Figure 3). The validity of the prediction model is confirmed by the figures of merit (Ratio SEC to SECV < 20%), confirming that NIR spectroscopy is a suitable analytical method to determine transition times of PCB laminates.

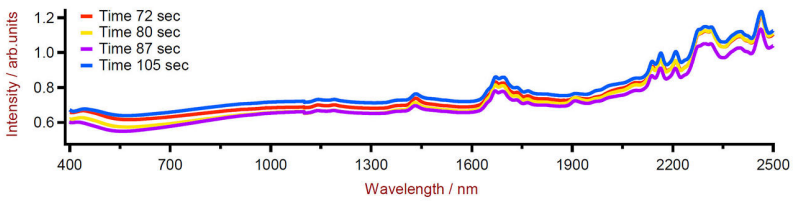

Figure 2. Vis-NIR spectra of polymer resins measured on a DS2500 Solid Analyzer.

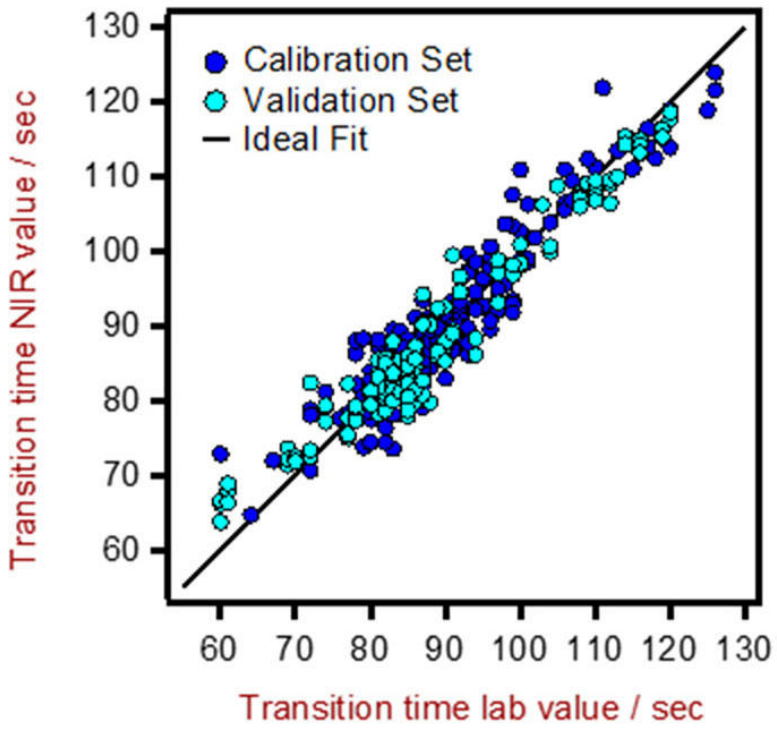

Figure 3. Correlation diagram for the prediction of transition times using a DS2500 Solid Analyzer.

Table 2. Figures of merit for the prediction of transition times using a DS2500 Solid Analyzer.

Figures of merit	Value
R^2	0.95
Standard error of calibration	3.64 s
Standard error of cross-validation	4.02 s

CONCLUSION

This application note demonstrates the feasibility of the DS2500 Solid Analyzer for the determination of transition times of polymer resins. Vis-NIR spectroscopy enables a fast determination without any sample preparation and therefore represents a suitable tool to check the transition kinetics of PCB laminates.

CONTACT

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DS2500 Solid Analyzer

坚固结实的近红外光谱仪,用于生产环境和试验室中的质量检查。

DS2500 分析仪是经过验证的灵活解决方案,用于对整个生产链过程中的固体、乳膏和液体进行常规分析。其坚固结实的设计使 DS2500 Analyzer 分析仪不受灰尘、湿度、振动和温度波动的影响,因此非常适用于在恶劣的生产环境中使用。

DS2500 涵盖了从 400 到 2500 nm 的整个光谱范围,并能在不到一分钟时间内提供准确和可再现的结果。DS2500 Analyzer 满足制药行业的要求,并由于操作简便而能帮助用户完成其日常工作任务。

由于与设备匹配,附件可以承受任何具有挑战性的样品类型,例如:粒料之类的粗颗粒固体或乳膏之类的半固体样品,可获得结果。测量固体的时候,使用 MultiSample Cup 可以提高生产率,可以自动批量测量多 9 个样品。

DS2500

用于在不同样品位置处使用 NIRS DS2500 Analyzer 采集粉末和颗粒反射光谱的大号样品容器。

Vision Air 2.0 Complete

Vision Air – 通用的光谱分析软件。

Vision Air Complete 是用于监管规范环境的先进易用的软件解决方案。

Vision Air 优点一览:

- 便捷的软件应用和经过适配的用户界面保证了直观简单的操作方式
- 操作过程的创建与维护方式简单
- SQL 数据库,可安全且简单地管理数据

Vision Air Complete (66072208) 版本包含所有用于可见近红外光谱分析质量保证过程的应用:

- 仪器和数据管理应用
- 方法开发应用
- 常规分析应用

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)