APPLICATION NOTE - 03

HITACHI
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LAB-X5000

LAB-X5000 for analysis of silicone coat weight on paper (including clay-coated and clay-filled) and film

BACKGROUND

Silicone is applied to a wide variety of papers such as glassine (supercalendered kraft, SCK), clay-coated kraft paper (CCK, which uses a layer of clay (kaolin) to fill the gaps between the fibres in the paper to smooth its surface), and clay-filled paper (for which clay is mixed with the wood pulp to reduce production costs).

Silicone coated papers are widely used as release liners, with the major application being stick-on labels of all types. Other uses include double-sided tapes, polymer films and decorative trims. In all cases the silicone-coated substrate protects a pressure-sensitive adhesive layer until it is needed, at which time the backing is peeled away. It is important to closely control the amount of silicone applied because too little will prevent the protective paper from being removed cleanly and too much is a waste of expensive material. Benchtop XRF analysers have been used for over twenty years to provide a cost-effective answer to this problem, offering rapid, precise analysis with the minimal sample preparation and operation by non-laboratory staff. The success of the method is that for the thin layers of silicone there is a simple linear relationship between the XRF silicon signal and coat weight.

As the industry looks to increase yield and reduce cost, production facilities need to take more measurements from side-to-side and start-to-finish. This requires analytical equipment to be faster to improve sample throughput. New substrates are being introduced for specialty applications and new market segments, requiring the testing equipment to be more flexible and future-proof. The LAB-X5000 achieves both of these improvements as a result of numerous improvements made to the leading line of LAB-X analysers.

Including Hitachi's high-resolution silicon drift detector SDD, the LAB-X5000 delivers results fast. It automatically corrects for the interferences present in the clay (e.g. alumina). The optimised "blank correction" enables users to measure all types of paper with one single calibration, correcting for the "baseline" under the silicone X-ray signal. All the operator has to do is measure a blank sample (i.e. not coated with silicone) before measuring production samples of the same type, and repeat this step every time the paper type changes. It's that simple!

Coat weight range (g/m^2)	Standard error of calibration (g/m^2)	Measurement time (s)	Limit of detection (g/m^2)	Limit of quantification (g/m^2)	Precision at mid range 95 % confidence (g/m^2)
0.00 - 2.28	0.01	60	0.003	0.010	0.006

Table 1. Typical calibration performance for silicone coat weight on glassine paper.

A series of well-characterised clay-coated samples were analysed using a glassine paper calibration. A silicone-free clay-coated sample was first measured as a BLANK. The results are shown in Table 2 and Graph 1 below.

Given Si coatweight (g/m^2)	LAB-X Result (g/m^2)
0.38	0.32
0.59	0.52
0.73	0.66
0.92	0.90
1.15	1.12
1.34	1.34
1.43	1.39

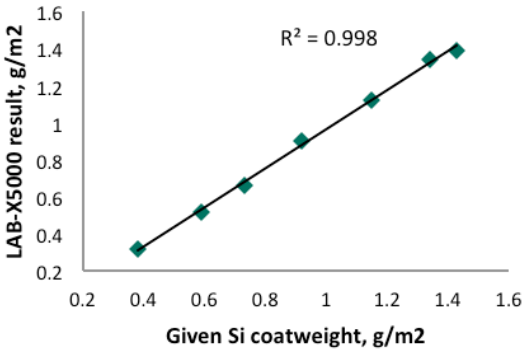

Table 2 and Graph 1. Accuracy data for clay-coated samples

SILICONE COAT WEIGHT ANALYSIS MADE EASY

The Hitachi LAB-X5000 energy dispersive X-ray fluorescence (EDXRF) analyser makes silicone coat weight analysis easy. This rugged, compact analyser is designed to provide reliable and reproducible results in laboratories or in production environments. The intuitive interface is displayed on a large, industrial touch screen. Streamlined software and one-touch measurement start function are inspired by our line of point-andshoot handheld analysers so any operator can get high quality results. Built-in atmospheric compensation allows analysis without the need for helium or vacuum purge, minimizing the cost per analysis. Because the silicone may not be homogeneously distributed over the sample, the LAB-X includes a sample spinner, enabling to analyse a wider area on the paper disc and delivering a reliable test result. The analytical method parameters have been optimised by applications engineers to simultaneously measure silicone and correct for interferences from clay-coated or clay-filled papers.

Samples are prepared with the provided cutter that produces discs that fit into our unique paper/film holders. The holder is placed into the instrument and within seconds results are displayed on the screen along with pass or fail messages so the operator can decide if changes should be made to production equipment. When the measurement is complete, an audible alert is generated to tell the operator that the instrument is ready for the next sample.

Advanced data handling capabilities include connectivity to LiveConnect, a cloud-based service for storing and managing analysis data anytime, anywhere. Locally, 100,000 results and spectra are stored on-board the analyser. Results can be printed on the integrated printer and transferred via USB.

The LAB-X brand has been trusted by the silicone industry for decades for its reliability, ease of use, stability and ruggedness.

Visit **www.hitachi-hightech.com/hha** for more information.

Hitachi High-Tech Analytical Science

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