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# EDXRF1140 - Analysis of silicone coating on paper and plastic



#### Scope

The analysis of silicone coating on paper, clay-coated paper, and plastic is demonstrated.

## Background

Paper and plastic are coated with a thin layer of silicone as a release coating in the manufacture of labels, tape, or other adhesives, or as a barrier coating for protection against air in the packaging of food, medical products, and other materials.

In a clay-coated paper, the clay coating adds weight and adjusts various physical properties such as paper glossiness and ink retention. During the coating process, the amount of silicone coating, usually expressed as coat weight in g/m2 or lbs/ream, must be periodically measured in order to ensure the proper physical properties of the product. When the coating is too heavy, silicone material is needlessly wasted, while too little coating may not meet the product spec. To achieve reliable QA/QC, Rigaku offers the <u>NEX QC</u> EDXRF analyzer. Simple to operate, NEX QC gives the QC technician an ideal tool for quickly checking silicone coat weight in order to maintain the highest product quality with minimal costs.

#### Units

Coat weight is expressed as mass/area, in other words, the amount of silicone per area of paper. Typical coat weight units are g/m<sup>2</sup>, also called gsm. Lower silicone levels may be expressed as mg/m<sup>2</sup>. In the US and other countries that use the Imperial system, the units lbs/ream are used (pounds per ream). A typical conversion is given here, based on 1 ream = 3000 ft <sup>2</sup>.

1.000 lbs/ream = 1.631 g/m<sup>2</sup> 1.000 g/m<sup>2</sup> = 0.613 lbs/ream

#### **Calibration – paper**

An empirical calibration was built using a set of assayed paper standards.

Paper (silicone 0.34 - 1.50 g/m<sup>2</sup>)

Element: Si Units: g/m <sup>2</sup>			
Sample I.D.	Standard value	Calculated value	
1	0.33	0.333	
2	0.44	0.431	
3	0.54	0.551	
4	0.62	0.616	
5	0.71	0.709	
6	1.50	1.500	



Correlation plot Si on paper

#### **Repeatability – paper**

To demonstrate repeatability (precision), the low and high coat weight samples were chosen from the set of calibration standards. Each sample was measured in static position with typical results shown below.

Element: Si		
Units: g/m²		

Sample I.D.	Standard value	Average value	Std. dev	% Relative
1	0.33	0.334	0.0022	0.7
6	1.50	1.506	0.0051	0.3

## Calibration - clay coated paper

Measuring silicone coating on clay-coated paper requires adjustment for variations in the clay coat. The clay coat may vary from roll to roll or along a roll, and various clays may have differing composition. The Rigaku approach corrects for the amount and composition of the clay on each particular sample, and a single calibration is used to measure varying clay coat samples.

To demonstrate, an empirical calibration was built using a set of low clay coat and high clay coat standards in which the clay composition itself varies. Automatic corrections are employed to correct for the variations in clay coat and clay composition.

Clay-coated paper (silicone 0.24 - 2.38 g/m<sup>2</sup>)

Element: Si Units: g/m²			
Sample I.D.	Standard value	Calculated value	
Н1	0.24	0.234	
H2	0.28	0.286	
НЗ	0.33	0.329	
H4	0.98	1.000	
Н5	1.11	1.103	
H6	1.14	1.125	
L1	0.59	0.598	
L2	1.08	1.062	
L3	1.26	1.263	
L4	1.42	1.406	
L5	1.58	1.599	
L6	2.38	2.380	



Correlation plot Si on clay-coated paper

#### Repeatability - clay-coated paper

To demonstrate repeatability (precision), the low and high silicone coat weight samples were chosen from the set of calibration standards. Each sample was measured in static position for ten repeat analyses with typical results shown below.

Element: Si Units: g/m²				
Sample I.D.	Standard value	Average value	Std. dev	% Relative
H1	0.24	0.257	0.014	5.8
L1	0.59	0.605	0.010	1.7
H6	1.14	1.131	0.006	0.5
L6	2.38	2.388	0.012	0.5

## **Calibration – plastic**

An empirical calibration was built using a set of assayed thin plastic standards.

Element: Si Units: g/m²			
Sample I.D.	Standard value	Calculated value	
1	0.56	0.568	

2	0.68	0.669
3	0.98	0.984
4	1.14	1.135
5	1.21	1.215
6	2.20	2.200



**Correlation plot Si on plastic** 

## **Repeatability – plastic**

To demonstrate repeatability (precision), the low and high coat weight samples were chosen from the set of calibration standards. Each sample was measured in static position with typical results shown below.

Element: Si Units: g/m²				Ť
Sample I.D.	Standard value	Average value	Std. dev	% Relative
1	0.56	0.554	0.0026	0.5
6	2.20	2.227	0.0064	0.3

#### Conclusion

The typical results detailed here show exceptional performance for the fast and simple measurement of silicone coat weight on paper and plastic in an air atmosphere without the need for helium purge. Rigaku's clay correction automatically adjusts silicone coat weight measurement based on the clay coat and clay composition of each particular sample being measured. The Rigaku NEX QC is an excellent tool for the quality control process in producing coated products, giving the production process an affordable means of optimizing quality while minimizing costs and helping to minimize product rejection and waste.

## **Related products**



#### **NEX QC Series**

Combines quality, affordability, and performance for a wide range of applications