Coat Weight Measurement System

Only measure the adhesive.
Coat Weight Measurement System

The coat weight measurement system is an accurate meter that uses infrared light technology.
Thicknes Meter Advantages

- Base film and ink do not affect measurement
- Adhesive measured separately by infrared
- Coat Weight Measurement System
- Non-contact, non-destruction and on-line measurement

"The thickness meter with chemical eyes"
<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring method</td>
<td>Infrared reflection absorption</td>
</tr>
<tr>
<td>Spectroscopic method</td>
<td>Rotating filter (6 filters can be installed)</td>
</tr>
<tr>
<td>Measurement distance</td>
<td>25 mm (from bottom of main unit)</td>
</tr>
<tr>
<td>Measurement area</td>
<td>5mm x 8mm (oval)</td>
</tr>
<tr>
<td>Sensor head</td>
<td>230mm (W) x 134mm (D) x 90mm (H), approx. 4.5 kg (excluding any protruding part)</td>
</tr>
<tr>
<td>Data processing unit</td>
<td>275mm (W) x 300mm (D) x 165mm (H), approx. 6.7 kg (excluding any protruding part)</td>
</tr>
<tr>
<td>Relay unit</td>
<td>250mm (W) x 140mm (D) x 113mm (H), approx. 3 kg (excluding any protruding part)</td>
</tr>
<tr>
<td>External output</td>
<td>Selectable from analog 0 to 10V or 4 to 20mA (set at factory)</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>0-40°C without condensation</td>
</tr>
<tr>
<td>Power supply</td>
<td>AC100V±10% 50/60Hz</td>
</tr>
</tbody>
</table>
Infrared Measuring Process

1. Infrared rays are irradiated towards the coated section.
2. The infrared absorption for each specific wavelength occurs in relation with the thickness of the coated section.
   The range or deepness of the wave will determine key parameters.
3. The amount of this absorption is determined from the transmitted light or mirror-reflected incident light.
   The relational expression for the previously obtained absorbance and moisture value is then used to calculate the thickness.
4. Our original P-polarized incident light technology is used to eliminate errors from surface reflection or internal multi-reflection.
   This provides the ideal hardware for an infrared thickness meter.
Features

Applicable for small space (inline):
The small sensor head requires no special installation space, allowing it to be installed in any small space available on the existing production line.

Excellent measurement accuracy:
Our original P-polarized incident light technology allows you to obtain stable measurements, even of film that is several μm or less in thickness.

Instant measurement:
No pretreatment is required, so thickness can be measured immediately without damage or contact.

Applicable in a broad range:
The thickness and moisture of various materials can be measured using combinations of filters for up to 6 wavelengths.

Reliable long-term stability:
The use of three-wavelength photometry ensures long-term accuracy against changes in ambient conditions and equipment.
## In-line Coat Weight Measurement Benefits

<table>
<thead>
<tr>
<th><strong>MINIMIZE</strong></th>
<th>Inspect if any factors causing defects:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quality</strong></td>
<td>1. Over coating, insufficient coating, and uneven coating</td>
</tr>
<tr>
<td><strong>Problems</strong></td>
<td>2. The incorrect mixing ratio</td>
</tr>
<tr>
<td></td>
<td>3. The usage of the reacted adhesive</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>IMPROVE</strong></th>
<th>Shorten the confirmation time before production</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Efficiency</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>MONITOR</strong></th>
<th>With on-line measurement, it is possible to continuously monitor production</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
</tr>
</tbody>
</table>

| **REDUCE**         | • Find out the quality problems in time to reduce the lot loss.              |
|--------------------|                                                                              |
| **Costs**          | • Early detection of quality problems will reduce material loss and customer returns. |
Quality Control

COATING WEIGHT MANAGEMENT
Simple and fast procedure to measure coating weight compared with traditional weigh-scale method.

By using on-line and non-contact system to measure the coating weight, the operators can perform the suitable adjustments without wasting time.

ADHESIVE MIXING RATIO CONFIRMATION
It is possible to confirm the mixing ratio and the mixing status by checking the measurement values.

ADHESIVE REACTION CONFIRMATION
Especially for controlling the adhesive with quick reactive time to ensure that the lamination has been done before reaction.
## Coating Weight Change | Coating Roller Ratio

<table>
<thead>
<tr>
<th>Coating Roller Ratio</th>
<th>Coating Weight (g/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>55%</td>
<td></td>
</tr>
<tr>
<td>65%</td>
<td></td>
</tr>
<tr>
<td>75%</td>
<td></td>
</tr>
<tr>
<td>85%</td>
<td></td>
</tr>
</tbody>
</table>

**Figure ① Change of Coating Weight with the Coating Roller Ratio**

- **Sensor Position:** Center
- **Line Speed:** 100m/min
- **Coating Roller Ratio:** 55% 65% 75% 85%
- **Resin Ratio:** 100%
- **Hardner Ratio:** 85%

**Correlativity of Coating Roller Ratio and Coating Weight**
Coating Weight Change | Line Speed

Sensor Position: Center
Line Speed: 100m/min, 200m/min, 250m/min, 300m/min
Coating Roller Ratio: 85%
Resin Ratio: 100%
Hardner Ratio: 85%

Figure ③ Change of Coating Weight with the Line Speed

Coating Weight (g/m²)

<table>
<thead>
<tr>
<th>Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>13</td>
</tr>
<tr>
<td>14</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>16</td>
</tr>
</tbody>
</table>

Coating Weight (g/m²)
### Coating Weight Change | Mix Ratio

<table>
<thead>
<tr>
<th>Sensor Position:</th>
<th>Center</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line Speed:</td>
<td>100m/min</td>
</tr>
<tr>
<td>Coating Roller Ratio:</td>
<td>85%</td>
</tr>
<tr>
<td>Resin Ratio:</td>
<td>100% 100% 5% 100%</td>
</tr>
<tr>
<td>Hardner Ratio:</td>
<td>85% 100% 100% 5%</td>
</tr>
</tbody>
</table>

#### Figure 4 Change of Measuring Data with the Mixing Ratio

![Graph showing coating weight change over time](image-url)

- **Coating Weight (g/m²)**: 1.4 to 3.0
- **Time (min)**: 23 to 38

The graph illustrates the change in coating weight over time, with specific data points highlighting variations in the mixing ratio.
Strength of thickness meter

The thickness meter with chemical “eyes”

Only measures the adhesive

Base film

Adhesive

It’s able to measure the substance separately by infrared

Won’t be affected by base film and ink

Non-contact, non-destruction and online measurement

The absorption of the ingredient A
The correlation with the Coating Weight

Correlation data (Calibration curve)

<table>
<thead>
<tr>
<th>NO.</th>
<th>Absorbance (A)</th>
<th>Coating Weight (B)</th>
<th>Operation Value (C)</th>
<th>Δ (C − B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base film</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.097</td>
<td>0.500</td>
<td>1.000</td>
<td>0.100</td>
</tr>
<tr>
<td>2</td>
<td>0.131</td>
<td>0.800</td>
<td>0.810</td>
<td>0.010</td>
</tr>
<tr>
<td>3</td>
<td>0.195</td>
<td>1.160</td>
<td>1.210</td>
<td>0.050</td>
</tr>
<tr>
<td>4</td>
<td>0.213</td>
<td>1.230</td>
<td>1.320</td>
<td>0.090</td>
</tr>
<tr>
<td>5</td>
<td>0.249</td>
<td>1.470</td>
<td>1.540</td>
<td>0.070</td>
</tr>
<tr>
<td>6</td>
<td>0.277</td>
<td>1.660</td>
<td>1.720</td>
<td>0.060</td>
</tr>
<tr>
<td>7</td>
<td>0.328</td>
<td>2.090</td>
<td>2.030</td>
<td>-0.060</td>
</tr>
<tr>
<td>8</td>
<td>0.360</td>
<td>2.300</td>
<td>2.230</td>
<td>-0.070</td>
</tr>
<tr>
<td>9</td>
<td>0.419</td>
<td>2.580</td>
<td>2.600</td>
<td>0.020</td>
</tr>
<tr>
<td>10</td>
<td>0.466</td>
<td>2.970</td>
<td>2.890</td>
<td>-0.080</td>
</tr>
</tbody>
</table>

Quadratic Coefficient: 0
Linear Coefficient: 6.1997
Constant Diagonal: 0
Standard Deviation: $\sigma = 0.061$

Calibration Curve of Non-solvent Adhesive

$y = 6.1962x$
$R^2 = 0.9947$

Temporary Calibration curve

Only amending the coefficient will be able to make calibration curve simply.
The usage of RX-200

- When the mixing ratio is 1:1
  - Actual: 2 g/m²
    - The thickness of adhesive layer
      - NCO: 2 → RX-200 Measurement Value: 2 g/m²
    - The thickness of adhesive changes
      - Actual: 4 g/m²
        - NCO: 4 → RX-200 Measurement Value: 4 g/m²
      - The thickness of adhesive layer is 2 times
        - NCO: 0 → RX-200 Measurement Value: 0 g/m²

☆ The measurement value of RX-200 changes when NCO amount changes!!

RX-200 is used as

Coating Weight Meter

- When the mixing ratio becomes uneven
  - Actual: 2 g/m²
    - NCO: 4 → RX-200 Measurement Value: 4 g/m²
      - When the mixing ratio is 1:1
        - Actual: 2 g/m²
          - NCO: 0 → RX-200 Measurement Value: 0 g/m²

☆ As the mixing ratio is wrong, the measurement value of RX-200 can not show the correct coating weight!!

RX-200 is used as

Mixing Ration Checker

The thickness of adhesive layer

☆ The mixing ratio is 1:1
  - Actual: 2 g/m²
  - NCO: 2 → RX-200 Measurement Value: 2 g/m²
  - NCO: 4 → RX-200 Measurement Value: 4 g/m²
  - NCO: 0 → RX-200 Measurement Value: 0 g/m²

KARLVILLE
Example

Coating weight (g/m²)

Line speed

100m/M

50m/M

Adjust the coating weight

The coating weight decrease after the adjustment

Coating weight over

- Analog output-----CH-1 (0-10V) or CH-2 (4-20mA)
- Parallel I/O----Remote control
  (Measurement start / stop; Alarm)

→ Output the measurement data to the laminator machine
→ Connect to the laminator machine
Installation Method - Solventless Laminator

① If the base film is transparent or printed, the mirror roll will be the reflector of the infrared. No matter which sides (inside/outside), the thickness of adhesive can be measured. ※The roll with hard chrome plating is necessary.

② If one side base film is VM, the aluminum side will be the reflector of the infrared. However, it is not possible to measure the inside adhesive of VM. Depends VM comes from which unwind (1st unwind or 2nd unwind), the thickness of adhesive might not be measured.

※Left one is possible to measure. ※Right one is impossible to measure.
  → Have to reverse the installation of the sensor head or transform the path line of the machine.
Machine Model | Configurations

**Compact MODEL**
- Only one web path required
- Sensor will be positioned on top of the web and will measure adhesive thickness before lamination

**Pro Series & Turret MODELS**
- Requires two web path configuration
- Sensor will be positioned on one side of the web and will measure adhesive thickness after lamination
System Configuration | One Web Path

[Diagram showing a process with Sensor Head, Base Film I, Adhesive, Base Film II, and Product.]

- **Unwind I**
  - Transparent or printed film
  - VMPET
  - VMCPP
  - Laminated products including VM (Note)

- **Unwind II**
  - Transparent or printed film
  - VMPET
  - VMCPP

(Note) Laminate VM laminated products and sealing is an exception.
Example Web Path
running laminates with metalized/foil material on either inside or outside of laminate structure.

To measure the thickness

By changing the web path based on the construction of the film, it is possible to measure the thickness of the adhesive for different laminate constructions with metalized/foil material.

Limitations

It is necessary for light to be able to penetrate thru one of the material layers.

The sensor cannot penetrate materials such as paper or other flexible materials with black ink, golden ink, and silver ink.
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Thank You!