Real-time non-contact wet or dry thickness measurement of pressure sensitive, water based, hot melt, laminating and other adhesives
Novel In-line coating thickness measurement technology

Uses ‘Ruggedized Optical Interference’ (ROI) technique

Yields coating thickness or film weight results

Lab and In-line configurations – with OEM options

Measurement of single or multiple layers

Rapid adoption by global metal packaging leaders

Recognized innovation award-winning technology:

EU: Metpack Gold Innovation Award
USA: AIMCAL Technology of Year
Asia: ICE Asia Innovation Award
Flexible Technology: Broad industrial utilization of technology

- Aerospace & Defense
- Medical Devices
- Automotive Industry
- Electronics
- Metal Coils and Containers
- Flexible Packaging
- Window Films
- Thin Films & Coatings
**Alternate Technologies: Optical and Non-optical tools**

- Multiple optical and non-optical methods available for thickness/coat weight measurement.

- Within optical field, several different measurement technologies used:
  - Optical Reflection
  - Optical Transmission
  - Optical Absorption

- Large number of optical thickness and coat weight measurement products available to the industry.

- *Most current tools either fall short or have significant limitations in production environments.*
Alternate Optical Technologies, with Limitations

**Optical Absorption/Transmission:**

- Non-absolute thickness measurement method
- Depends on magnitude of absorption/transmission levels
- Limited wavelengths versus broad wavelength range
- Different wavelengths used for different coatings
- Not suitable for discrete layer measurements
Alternate Non-Optical Technologies, with Limitations

Beta/Gamma Nuclear gauging:

- Non-absolute thickness measurement method
- Differential type of measurement technique
- Extra administrative and costs burdens
- Cannot measure thinner coatings below 5 microns
- Cannot measure individual layer thickness
- Substrate variations have an impact on accuracy.
- Dual scanning heads for differential increases cost
Overview: Exclusive ROI Optical technologies

- Proprietary ‘**ruggedized optical interference**’ ROI technology
- Absolute thickness measurement results
- Substrate independent
- Measures clear and opaque coatings
- Not affected by base color or printed substrate
- Uses non-invasive white light optical source(s)
- Scalable for off-line or In-process use for wet or dry coating measurement use
- Current range: 0.15 to 250 micron thickness (0.2 g/m² to 300g/m²) or (0.006 to 10 mils)
Technical advantages: ROI optical methods

- **Discrete layer measurements**
  - Not a differential or total coat weight measurement method
  - Discrete film weights of single or dual layers can be measured

- **Absolute thickness measurements**
  - Highly precise and real-time measurement data in real-time
  - Single streamlined In-line system can replace multiple systems
    - One system can measure two layers simultaneously
  - No necessity to calibrate on supplied thickness/weight standards
    - No need to *teach* the system since actual coating thickness is measured.

- **Takes wet or dry in-process coating/layer measurements**
  - Ability to monitor coatings immediately after application
  - Multiple probe and scanning configurations to meet QA needs

- **Fast, non-contact and non-destructive method**
  - Continuous readings eliminate need for weight tests on discs
  - Sample integrity is maintained
  - No source degradation
  - Intrinsically safe probes for wet coatings
Data Analysis: ROI technology data outputs

Precise thickness and coat weight results:
- nanometers
- mg/sq. inch
- microns
- gsm
- mils
- lbs/ream

Simple user and operator interfaces
Requires minimal input from operator
OPC, TCP/IP, PLC integration options

Management gets more reliable results:
- Automatic data recording and storage
- No manual recording or data manipulation
- Direct porting to SPC and QA systems
Lab system: View of multiple layer coating stack

- Simultaneous measurement of multiple coated layers
- Reflection is generated from each interface of multi-layer surfaces
- Thickness peaks shown for individual layers and combination of layers
- Suitable for adjacent layers with dissimilar refractive index values
- Well-suited for ‘film weight forensics’: review of finished coated products
Gage R&R results
Performance: Customer Gage R&R Results

- Actual Gage R&R test result using NIST thickness standards
- Certified standard used so that only gauge variability is tested
- All SpecMetrix systems pass a <5% Gage R&R requirement
Range of Use: QA and production applications

Corporate Teams
- QA Labs and sample testing
- Technical and R&D centers
- Pilot lines
- Coating supplier tech centers
- Film weight forensics/ Claim review

Manufacturing Plants
- QA work stations
- Incoming coil inspection
- Coating and print lines
- Coil and component suppliers
- In-process coating measurements
In-Process Benefits: Technology impact on production

- Elimination of labor intensive and less accurate weight gauging
- Optimized coating utilization and film weight distribution
- Real-time adjustments can be made to in-process adhesive layers
- Streamlined film weight checks and 1st piece inspections
- Traceable quality certifications for each production run or coil
- Reduced product rework and less coating spoilage
- Objective measurement data supply helps eliminate manual errors
- Reduced new coating trial times, set-up and changeover times
- Reductions in waste streams, solvent, coating and oven usage
Technology Implementation: Multi-Channel fixed

Regularly used for in-process coating measurement for 100% inspection on fixed points.
Technology Implementation: Dual layers or coatings

Dual line configuration for sequential measurement of two coating layers
Technology Implementation - Scanning systems

Provides full side-to-side coating thickness characterization over webs or coils
Light weight and robust scanning heads compared to traditional scanning gages
Technology Implementation – EU Pilot Line
Interface Options: Control and data integration

SpecMetrix Communication Interfaces

SpecMetrix Communication Interfaces

OPC Server

Manufacturer Processes

SPC / MES (i.e. Wonderware)  Siemens  Allen Bradley
Trials and Measurement results
Performance: Measurement stability over time

- Measurements taken on same sample daily for **five** days
- High demonstrated repeatability over extended periods

<table>
<thead>
<tr>
<th>Product</th>
<th>Days</th>
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<th>Layer3</th>
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Performance: Correlation of wet (inline) to dry results

- Thickness of wet and dry in-line measurements taken over an extended period of time on applied coating
- Wet coating inspection performed immediately after coating application
- Strong correlation between wet and dry measurement results

<table>
<thead>
<tr>
<th>Meas #</th>
<th>Wet Thickness</th>
<th>Dry Thickness</th>
<th>Correlation factor</th>
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<td>5</td>
<td>22.20</td>
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Pressure Sensitive Adhesive on Film and Siliconized paper
Results: PSA on film

- Real time measurement of PSA adhesives on films
- Successful real time measurements on pigmented adhesives as well
- Adhesive measured in the dry state but can also be measured in the wet state
- Film thickness can be measured simultaneously as well

<table>
<thead>
<tr>
<th>Meas #</th>
<th>Adhesive (mils)</th>
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<td>AVERAGE</td>
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Results: PSA on Siliconized Paper

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<td>AVERAGE</td>
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Real time measurement of PSA Adhesive on Siliconized Paper
Results on different Adhesives
Results: Exclusive Adhesive measurement on patterned films

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<th>Sample</th>
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<td>4</td>
<td>6.87</td>
</tr>
<tr>
<td>5</td>
<td>6.91</td>
</tr>
</tbody>
</table>

- Adhesive and film thickness measurement on RFID tags
- Over application or under application of adhesive affects results appreciably.
- Adhesive is applied over a small 3 mm² area.
- Measured both inline and offline
- No other alternative measurement due to small measurement area and thickness.
Results: Kapton Tape

- Simultaneous measurement of film and adhesive layer
- Used for flexible circuitry
- Excellent Thermal performance
- For applications involving extreme heat and vibration
- Straight forward for ROI thickness measurement technology
- Can be measured both as a free standing film and on the roll itself
**Results:** Simultaneous measurement of laminating and pressure sensitive adhesive

<table>
<thead>
<tr>
<th>Meas#</th>
<th>DL Adhesive thickness(µ)</th>
<th>Scratch Resistant thickness(µ)</th>
<th>PS adhesive thickness(µ)</th>
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<td>5</td>
<td>3.27</td>
<td>1.61</td>
<td>6.87</td>
</tr>
</tbody>
</table>

- Successful measurement of laminating adhesive, film and pressure sensitive layers
- Underlying problems with particular layer(s) within film stack identified
- No need for dual systems for double coating or film measurements
Conclusions & Opportunities

- Robust, high-speed, accurate thickness measurement technology
- Flexible technology for diverse set of applications & markets
- Excellent results on multiple applications for adhesive coatings
- Ability to measure wet or dry adhesives and dual in-process layers
- Adhesives on multiple substrates can be more precisely measured such as film, siliconized paper, foil etc.
- Different types of adhesives can be measured such as solvent based, pressure sensitive, hot melt, water based adhesives, etc.
- Fixed point or traversing measurement configurations available
Questions?

For additional information:

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www.specmetrix.com

For system demos:

AIMCAL - Table Top Display