Greener production processes and continuous process improvement through the use of next generation coating thickness measurement methods
Novel eco-friendly coating thickness measurement technology

Uses ‘Ruggedized Optical Interference’ (ROI) technique

Non-radioactive, non-destructive measurement tool

Yields real-time coating thickness or film weight results

Measurement of the thin single or multiple layers

Rapid adoption by global 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 Non-Optical Technologies, with Limitations

X-Ray Fluorescence Technologies:

- Radioactive technology that generates ionization radiation
- Indirect thickness measurement
- Usage of hazardous materials necessary in some cases
- Measurements take several seconds to a minute
- Cannot measure individual layer thickness
- Substrate variations have an impact on accuracy
- Very sensitive to surface roughness and web flutter
Alternate Non-Optical Technologies, with Limitations

**Beta/Gamma Nuclear Technologies:**

- Non-absolute thickness measurement method
- Differential type of measurement technique
- Cannot measure thinner coatings below 5 microns
- Nuclear sources with life/disposal challenges
- Substrate variations have an impact on accuracy
- Dual scanning heads for differential increases cost
- Extra administrative, staffing and cost burdens
Overview: Exclusive ROI Optical technologies

- Proprietary ‘**ruggedized optical interference**’ ROI technology
- Absolute thickness measurement results
- Non-hazardous and 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
- Thin current range: 0.15 to 250 micron thickness (0.2 g/m² to 300 g/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 thickness 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, non-radioactive and non-destructive method**
  - Continuous readings eliminate need for weight tests on discs
  - Non-nuclear and non-radioactive white light source
  - 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
- Highly accurate real-time lane or web data
- Direct porting to SPC and QA systems
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
QA data can be collected without wasteful destruction of sample
Consistent 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
- Better R&R performance means less waste and over-application
Broad Range of Use: QA and production applications

Corporate & Quality Teams
- QA Labs and sample testing
- Technical and R&D centers
- Pilot and lab lines
- Coating supplier tech centers
- Film weight forensics/ Claim review
- Faster testing with less time and waste

Manufacturing Plants
- QA work stations
- Incoming web inspection
- Coating, print and converting lines
- Web, coating and adhesive suppliers
- In-process coating measurements
In-Process Benefits:
Technology impact on production

- Elimination of labor intensive and less accurate weight gauging
- Avoidance of customer claims through improved QA data per run
- 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
- Reduction in film weight measurement steps
- Elimination of coating thickness variation between sides of sheet
- Traceable quality certifications for each production run or coil
- Objective measurement data supply helps eliminate manual errors
In-Process Green Benefits:
Technology impact on production

- Non-Nuclear technology: no alpha, beta or gamma radiation
- Non-radioactive technology: no use of hazardous materials that generate ionization radiation
- Non-destructive technology: less waste as product integrity maintained
- Reduction in coating chemicals by reducing coating over application
- Energy efficiency by speeding up coating trial times, set-up and changeover times
- Reduced product rework, solvent emissions and coating spoilage due to under application
- Decreased oven usage and curing time to dry coatings
### Additional In-Process Green Benefits: Technology impact on production

- Minimize plant waste streams, such as powder coating materials or particulates and solvents. Customers have reported reduced plant waste streams of up to 75%.
- Decrease Volatile Organic Compounds (VOCs) emitted from paints, coatings, films and solvents at low temperatures by quickly gauging thicknesses without the use of increased or repeated contact or heat.
- Help paper, film, foil and other web processing facilities meet air pollutant emission standards set by applicable air quality boards.
- Reduce environmental impact and reduce plant costs with one solution.
Technological 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 gauges
Interface Options: Control and data integration
### Performance: Measurement stability over time

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<tr>
<th>Product</th>
<th>Days</th>
<th>Layer1</th>
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<th>Layer3</th>
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- Measurements taken on same sample daily for **five** days
- High demonstrated repeatability over extended periods
Performance: Correlation of wet (inline) to dry results

<table>
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<tr>
<th>Meas #</th>
<th>Wet Thickness</th>
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<th>Correlation factor</th>
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- 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
Performance: Simultaneous measurement of layers

<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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<tbody>
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<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
- Reduces greenhouse gas emissions that were produced by traditional methods of gauging film thickness
- Non-contact and non-destructive measurement method
- Non-nuclear, non-radioactive and non-ionizing technology
- Flexible technology for diverse set of applications & markets
- Ability to measure wet or dry adhesives and dual in-process layers
- Fixed point or traversing measurement configurations available
- Minimizes waste streams, saves energy, and increases overall plant productivity by eliminating the need to rework and re-measure products
Questions? Next steps?

For additional information or to arrange on-site demonstrations or pilot line trials, contact:

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