Next Generation Equipment for the Precision Coating of Performance Film, Foil and Paper

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Next Generation Equipment for the Precision Coating of Performance Film, Foil and Paper

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Next Generation Equipment - Vision and Competence

... lead to Solutions
SOLUTION needed for High-End Products

Industrial and Automotive
- Label stock and tapes
- Packaging

Medical
- Battery
- Release paper and films

Electronics
- Optical
- Graphics
Vision and Competence

KEY PROCESSES
and their right selection

Supporting processes
- web cleaning
- surface treatment
- process measurements (i.e. LEL)
- product measurements (i.e. thickness)
- ...and many more

...prerequisite to enable customized processes
Next Generation Equipment – Innovation put into Action
Olbrich Pilot Line – BA2
Innovation put into action - BA2
Sophisticated Coating Line for Functional Applications
overview

Technical Data: Web width_{max} = 1050 mm
v_{mech} = 2.5 – 500 m/min

Technical specification

- Cartridge-type coating head changeover system
- IR / UV systems
- Flexible drying and tempering sections
- Laminating station
- Contact and orbital type turret rewinder

Precision coating & drying systems and advanced winding technology inspire tomorrow’s innovative products!
Key Processes
OLBRICH Pilot Line – BA2

- Coating
- Winding
- Drying
- Drives & Controls
- Winding
- Coating
Innovation put into action - BA2
Sophisticated Coating Line for Functional Applications
Unwinding section

Technical specification

- Single-roll unwind system
- Web cleaning
- Heating and cooling rollers for relaxation of pre-stressed foils, normalized substrate conditions
- Corona treatment with max. 16 kW capacity
Innovation put into action - BA2
Sophisticated Coating Line for Functional Applications
Coating Section

Coating Systems
smooth/gravure roll - die

Self metered
by contact
2,3,...rolls
direct (forward / reverse)

contactless
rotating
indirect (forward / reverse)

Pre-metered
by contact
gravure roll
open pan
pressureless

contactless
stationary
commabar
closed
pressurized

Coating section
Cartridge-type coating head changeover system

Coating fluid (rheology)
Coating compound / thickness
Production Speed
Surface quality
Substrate quality
...and many more
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Sophisticated Coating Line for Functional Applications
→ Doctor Blade PGS cartridge as example

Coating Systems
smooth/gravure roll - die

Pre-metered
by contact
gravure roll
closed
pressurized
Innovation put into action - BA2
Sophisticated Coating Line for Functional Applications
Drying Section
Drying Section

Drying Technology:

- 4x sections of dryers (independent upper and lower air circulation)
- 1x cooling section
- CTS, TP, HiCon “VacRoll”, HiCon “AirFlotation” nozzle technology
- Slot / hole nozzle design
- Ex-operating conditions
- State-of-the-art process control system

Web infeed from coating station into 1st drying section

Innovation put into action - BA2
Sophisticated Coating Line for Functional Applications
Drying Section
Innovation put into action – BA2
Oven Outlet, Suction Roll,
Optical Thickness Measuring System
Quality Control Section - Traversing Measuring System

...provides full side-to-side coating & film layer thickness measurement
Innovation put into action - BA2
Sophisticated Coating Line for Functional Applications
Rewinding Section – Laminating Station & Turret Rewinder
Trust is Good, Control is Better!

To Qualify Coating Techniques, we MUST have Detailed Information Concerning:-

✓ ...the coat weight (MD / CD)
✓ ...the substrate
✓ ...the idiosyncrasies of the coating method used
✓ ...the type of coating (properties)
✓ ...current / live, inline operation

+ ...the “final” coating layer characteristics (overall quality with respect to defects etc.)

➢ Decision/ Consequence: Optical Interference Technology
Next Generation Equipment – Optical Film Thickness Measurement System

Principle: Spectral Reflectance + analysis of optical interference wave

- Non-contact
- Non-destructive
- Real time data capable
- Inline compatible system, thickness measurement of wet or dry coatings

Source: Sensory Analytics
PSA applied by Pressurized Chamber Gravure Coating
Coating using Pressurized Chamber Gravure Coating System

Pressurized coating system is able to overfill the gravure roll (depends on gravure design) and enables a wide operating range whilst reducing foaming.
Type PGS

• **ZONE 1**
  Coating Inlet and working width distribution

• **ZONE 2**
  Main dosing of coating liquid

• **ZONE 3**
  Pre-filling

• **ZONE 4**
  Backflow with Air Contamination
Next Generation Equipment – Case Study I
SpecMetrix – Lane Graphs

- Difference (High–Low) = 0.6µ
- No pumping effect visible from gravure lines
Next Generation Equipment – Case Study I
SpecMetrix – CD Graph

• Adhesive coat weight in tight range
• Adhesive coat weight largely independent of PET variations
The variation in coat weight across the web was measured to be 0.6µ. This amounts to just ±2% on total dry coat weight. This is within the manufacturing tolerance of the gravure roll itself.

In the past, this coating technique has been criticised as coating thicker on one side of the web than the other due to a so-called pumping effect of the trihelical gravure. The measurements show that special chamber design to prevent internal currents has eliminated this problem.
Coating with Comma bar

- Precision metering system
- CD profile compensable
- Able to handle viscous coating media

But....

- Radial run-out of backing roll
- Substrate variation
- Temperature of coating liquid / rolls
- Shear thinning / level of filling chamber
- ...

⇒ Opportunity for real time measurements and data mining for qualification of this coating technique
⇒ Coat 23µ liquid onto 38µ PET
Next Generation Equipment – Case Study II
Qualifying Comma bar Coating System

SpecMetrix: Simultaneous Measurements of PET & Coating at 1-second intervals

- Large variation
- Periodicity
- Mirror effect
Calibrated gap means that when the PET is thicker, the coating is thinner
- Variation in PET thickness 1.33µ (3.5% rel.)
- Variation in coating thickness 1.74µ (7.7% rel.)
- Difference shows that additional errors are present

Check the periodicity observed
- Adding coating + PET must give constant value ... ?

More data mining
Variation = 1.05µ

Period [s] at machine speed run corresponds almost exactly to circumference of backing roll
Next Generation Equipment – Case Study II
Qualifying Comma bar Coating System
Conclusions

- Addition shows that the variation in total thickness is 1.05µ
- Analysis shows that this is the total run-out of the backing roll. This is a low, excellent value for a manufacturing tolerance
- Variation in PET thickness 1.33µ (1)
- Variation due to run-out 1.05µ (2)
- Variation in coating thickness 1.74µ - why not higher?
  ➔ Must wait for alignment of 1+2 to see full swing in coat weight.

Conclusions:
- The potential coating variation of this system [Comma bar + PET] starts at ca. 2.4µ error. Ca. 55% of this error comes from the substrate in this case.
- Depending on the total coating thickness, the relative error may render the system to be non-process capable.
• Optical measurement systems enable us to perform detective work with coating systems and gain a deep understanding of:-
  • The coating process
  • Mechanical constraints
  • The Substrate quality
  • Variations in coat weight and coating distribution
• Feeding this knowledge back into the design stage of precision coating equipment shapes the next generation of products
❖ If you can’t measure it, you can’t improve it

! Many thanks to Dyetra.de for their assistance
CONCLUSION: Next Generation Equipment must provide 100% control of the PRECISION COATING process

... means controlling of:

1) Quality
- Profile (MD/CD) Optical Measuring System
- Defects (Coating Layer) Web Inspection System

2) Quantity
- Amount of Variations / Defects

- Possessing Know-why
  Process Technology Expertise required in order to determine “The Processes”

- Possessing Know-how
  Design Engineering Expertise required in order to transform ideas in to “Machinery Equipment”
Any Questions? – Please talk to us at the tabletop exhibition