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Double side coating methods for paper and films

Joerg Pahle-Kraas

&

Ralph Pagendarm

SAM SUNGAN
PAGENDARM

SAM Sungan Ralph Pagendarm
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Worldwide competition forces film manufacturers to offer added value to their film production lines.

Many products of paper and films are double side coated. Conventionally this is done in 2 steps with intermediate drying and web guiding.

This presentation will outline double sided coating methods for paper and film, which are done simultaneously – without intermediate drying.

Advantages are manifold as cost savings, shorter web length, easier operation.
Front and back side coating with same or different coating fluids are possible

Front and back side coating weights could be the same or different

Common solutions are: direct and indirect gravure coating, typically with kiss coat transfer combined with air floatation dryer. The air floatation dryer guarantees perfect web stability for a wide operation range of web tension and air flow.

Air floatation dryer with perfect web stability ad a wide operating window

What can be accomplished with a suitable double side coater?
## Introduction

### Coating Methods

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<td>Air Knife</td>
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Coating Methods
Spray Coater

Technical Properties
- No backing roll
- No kiss coat
- Only applicable for low viscosity media

Operation always without backup roll limits application → no edge free coating is possible
Coating Methods
Reverse Gravure (Anilox) & Kiss Coat

Coating surface depends on
- Rheology of coating media
- Web tension
- Wrap angle
- Control of contact area

For double side coating: Kiss coat surface is not as good as gravure roll coating with backing roll

Solutions for better contact available

Direct

Indirect
Coating Methods
Reverse Gravure (Anilox) & Backing Roll

Backing roll improves coating surface \(\rightarrow\) improving coating results

For almost all coatings, because
- Contact area mechanical adjusted
- Not depending on web tension

Coating surface depends on
- Rheology of coating media

For double side coating: Application with and without backing roll. 1st coating unit with, 2nd without Backing roll possible
Double Side Coating
Possible Solutions

What combinations of possible coating methods are applicable?

Almost not applicable (2x Direct gravure Coating)

Almost not applicable (2x Indirect gravure Coating)
- Both transfer rolls are running synchronous
Double Side Coating
Possible Solutions

Applicable (2 x kiss coat direct)
- Adjustable contact area
- Adjustable web tension
- Coating quality according to kiss coat conditions
- Optical inspection of web not easy
- Coating fluid supply above web

Applicable (2 x kiss coat indirect)
- Adjustable contact area
- Adjustable web tension
- Coating quality according to kiss coat conditions
Double Side Coating
Possible Solutions

Applicable (2 x kiss coat direct)
- Adjustable contact area
- Adjustable web tension
- Coating quality according to kiss coat conditions

Applicable (2 x kiss coat direct with Mayerbar)
- All kiss coat (kiss coat direct, indirect or fountain die) applications are applicable with Mayerbar
Double Side Coating
Possible Solutions

Applicable (Kiss coat with backing roll & kiss coat direct)
- Adjustable contact area
- Adjustable web tension
- Coating quality according to backing roll conditions (1. coating) and kiss coat conditions (2. coating)
- Coating fluid supply above web
Double Side Coating
Construction for double Kiss Coat

Substrate flow direction

Coating

Coating
Double Side Coating
Construction for Fountain Die

Available systems with spray, Mayerbar and fountain die combinations
Double Side Coating

Conclusion

Inline Coating Film stretching

The inline coater allows enhancement to the film between the MDO and TDO just before cross stretching.

Most technical relevant application are direct gravure & kiss coat, Meyerbar with kiss, roller or fountain die coating, because coating accuracy is sufficient (no functional coating). Coating media viscosity range similar to water ~ 1 mPa s

Coating weight is dominated by stretching factor, very thin coatings possible

Offline Coating

Typical applications are primer, top coat, PVDC or Lacquering, resulting in higher viscosity range for coating media up to 100 mPa s

One functional (gravure & backing roll) and one primer or silicone (kiss) coating applicable

Double side coating with kiss coat is applicable

Technical solutions for higher accuracy of kiss coat available on demand

Coating fluids with solid contend higher than 30% are difficult
The coating result is a function of contact area, time (web speed) and coating media rheology. Contact area is a direct function of web angles and web tension.

The web tension inside the dryer is a result of the adjusted web tension for the coating process. It is not possible to separate the web tension of coater and dryer.

The dryer has to fulfill:
- Wide operating window (air speed and web tension)
- Perfect web stability due to no lateral return air flows in the entire dryer
- Perfectly even air and temperature distribution

Right Solution are Air Floatation Dryer
Single Side Coating Line
Thermal Management
Double Side Coating Line
System Layout for Barrier Layer

Dryer 1a  Dryer 2a  Dryer 1b  Dryer 2b
Primer 1  Unwinder  Coating 1  Primer 2  Coating 2  Rewinder

Dryer 1  Dryer 2
Unwinder

Primer 1/2  Coating 1/2  Rewinder
Double Side Coating Line
Thermal Management
Double Side Coating Line
Thermal Management: Conclusion

Principal Thermal Behaviour Single vs. Double Side Coating

length of web in system
Inline Coating Film stretching

Inline coaters are a unique solution to *upgrade* an *existing film stretching line*. The inline coater allows enhancement to the film between the MDO and TDO just before cross stretching.

Offline Coating

Kiss coating and backing roll coating are capable applications. Spray coatings and direct gravure coating only for special applications
All kiss coat (kiss coat direct, indirect or fountain die) applications are applicable with Mayerbar
Not capable for all functional coating applications, because only one side in backing roll quality
Conclusion

Costs

Minimization of invest cost by reducing:
- Dryer length and framework
- Coating units
- System control software
- Double Side Coater Line at 75% of single Side Coating Line

Optimization of energy consumption
- Heating ~ 15% reduction
- Cooling ~ 17% reduction

Technical

Reduction of web and system length
Reduction of thermal stress to web
Strong requirements for dryers
Limitations in web tension
Appendix

Links and Books

[8] Växjö Laminierung AB Smedjegatan 22 35246 Växjö
[9] Kleine Werkstoffkunde Kunststoffe; Maurer Schallschutz; Anthoptstrasse 9 /SIG Halle 104