Intelligent Design of Yankee Coatings

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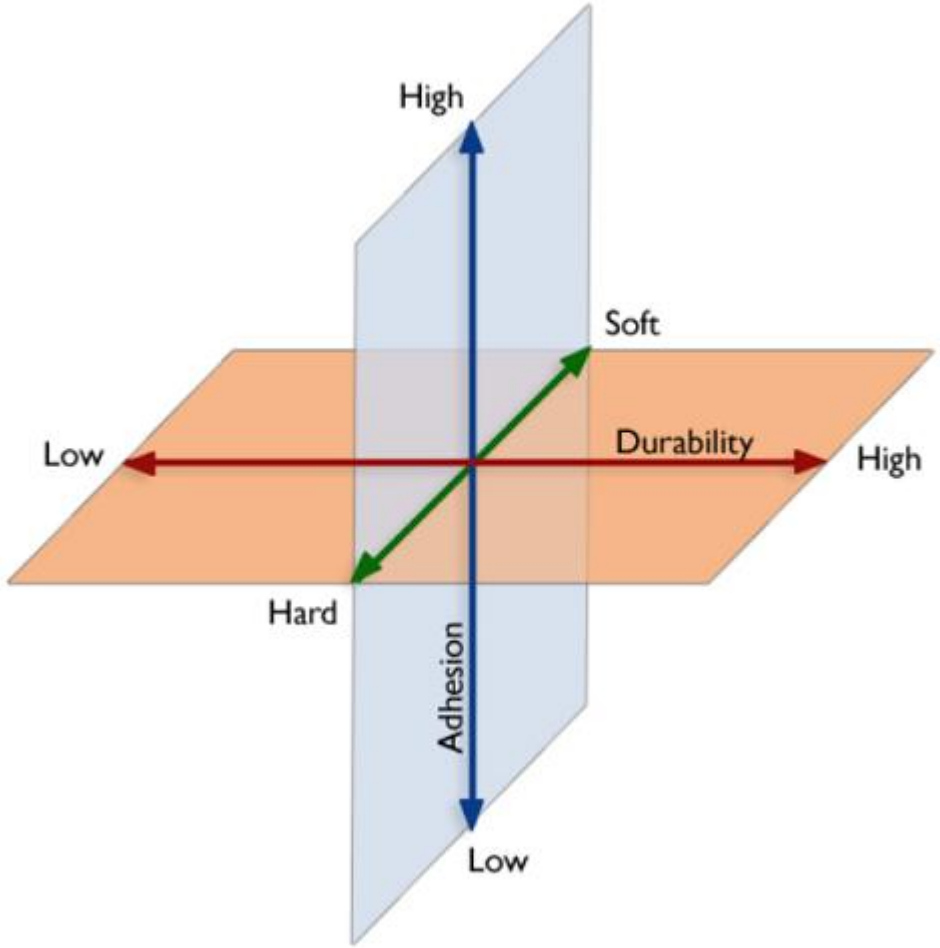
Yankee Coating Critical Functions

All coatings must,

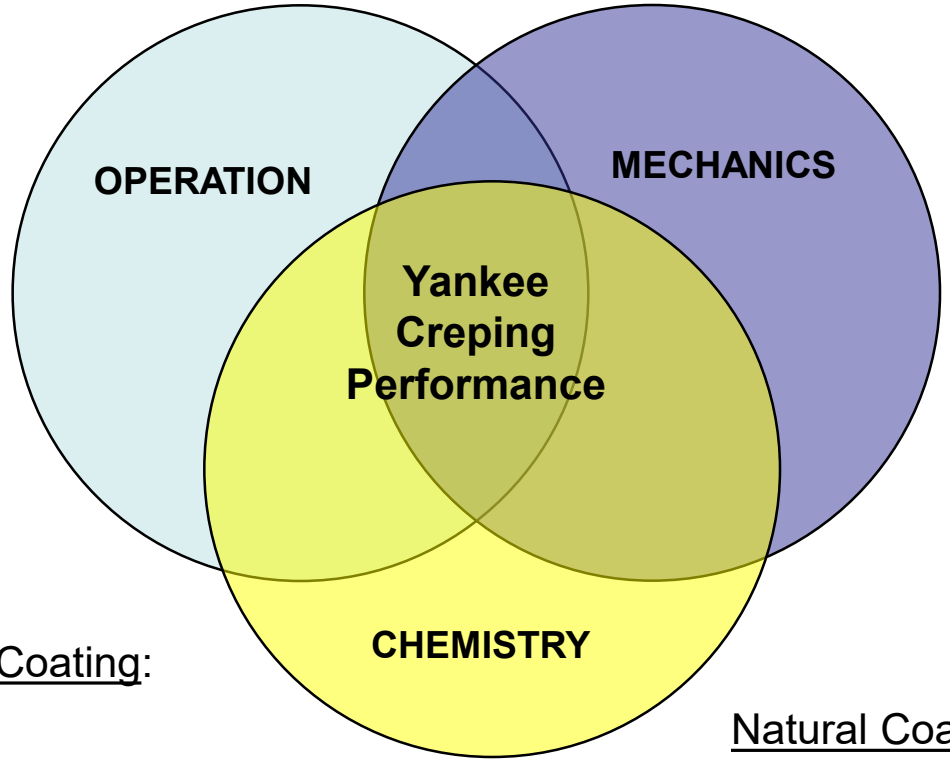
1. Protect the Yankee surface
2. Provide adequate adhesion
   a) At transfer
   b) At creping blade
3. Have correct film softness



Coating Space™, Archer, *et. al.* ABTCP Conference, Sao Paulo, Brazil, October 2005.

Yankee Creping Performance: Key Factors

Moisture Level
Moisture Profile
Yankee temp
Hood temp Machine speed
Furnish
Wet end chemistry
Felt cleanliness
Add-on levels
Boom water temp



Creping geometry
- Blade holder <
- Blade bevel <

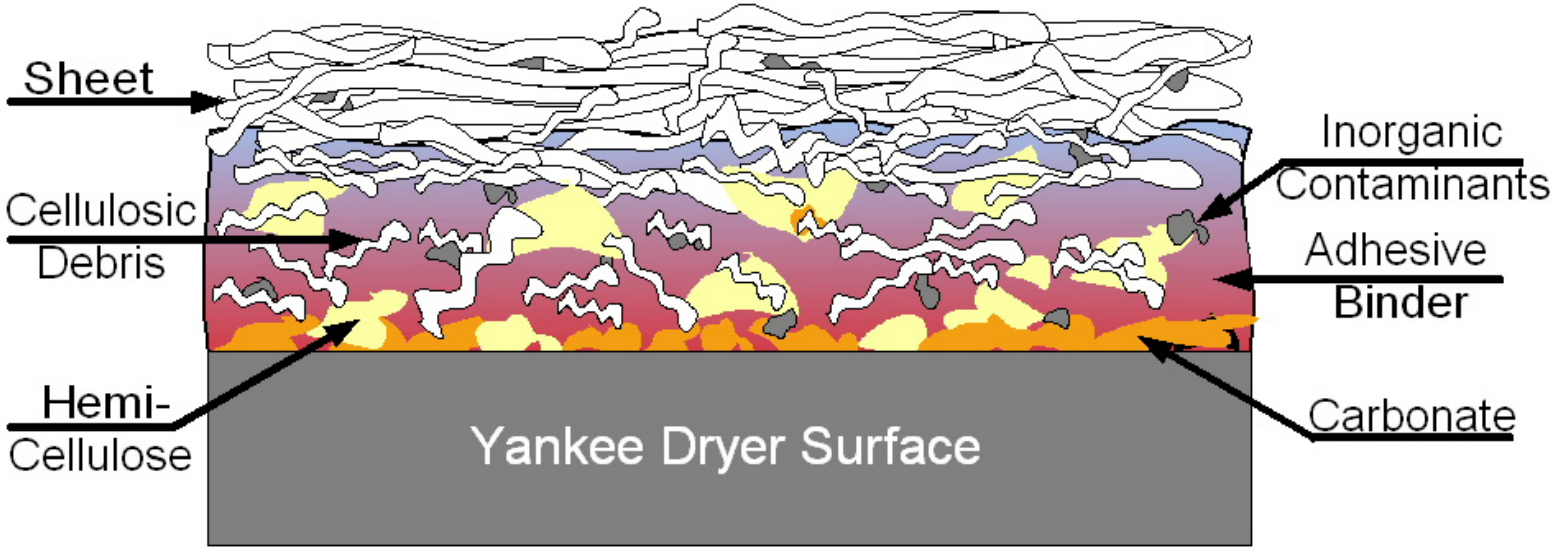
Blade
- Type
- Loading
- Thickness
- Stickout
- Cleaning blade use

Spray Boom
- Position
- Nozzle type
- Coverage pattern

Synthetic Coating:
Adhesive
Release
Modifiers
Phosphates

Natural Coating:
Hemicellulose
Fines
Inorganics
Wet end additives

Yankee Coating Components



Delivered *via* spray boom

- Adhesives
- Releases
- Modifiers
- Phosphates

Transferred from wet end and sheet

- Hemicelluloses
- Fines and fibrillar material
- Inorganics
- Wet end additives

Coating Component Definitions (1)

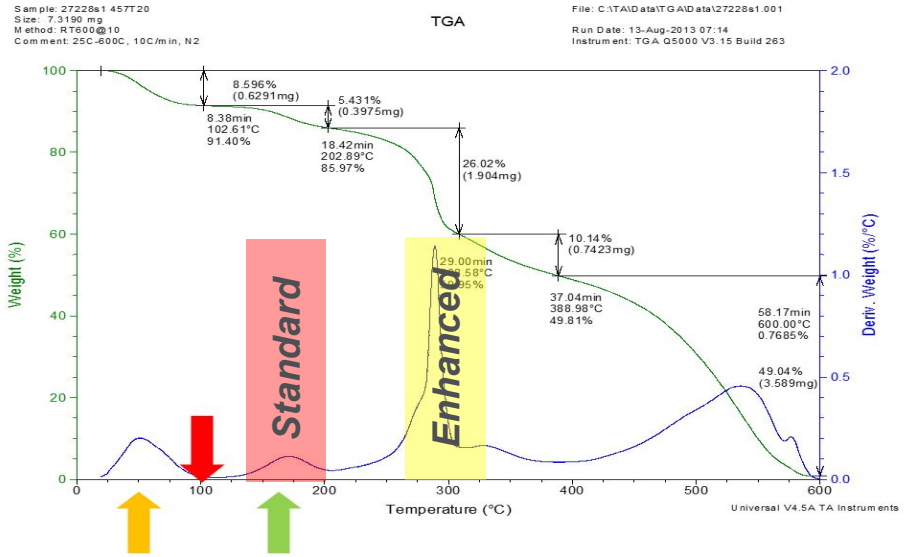
- Adhesive – functions to form the main cohesive protective film or coating on the Yankee while providing necessary transfer and creping adhesion; typically film forming polymers
- Release – typically oil-based with added surfactants for emulsification; provides release off Yankee and blade, while controlling coating build

Coating Component Definitions (2)

- Modifier – typically surfactant-based and more compatible with adhesives than release oils; can soften and increase uniformity of the coating as well as provide release
- Humectant – helps retain moisture in the coating to keep it flexible and soft while remaining adhesive
- Phosphate – inorganic protective agents for the Yankee; can help anchor the coating providing uniformity

Example of Adhesive Design Parameters

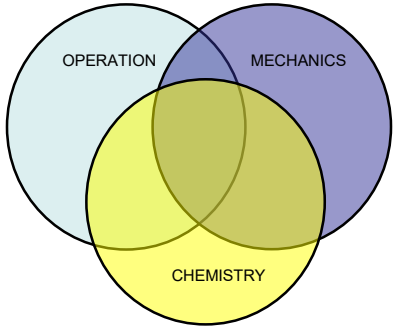
- Polymer composition and conformation
  - monomer ratios, hydrophilicity, charge, block or random
  - linear, branched, crosslinked, novel architectures
- Polymer molecular weight and distribution
- Reactivity
- Polymer water uptake and water holding capability
- Modification techniques



Impacts on YC Design – Grade Factors

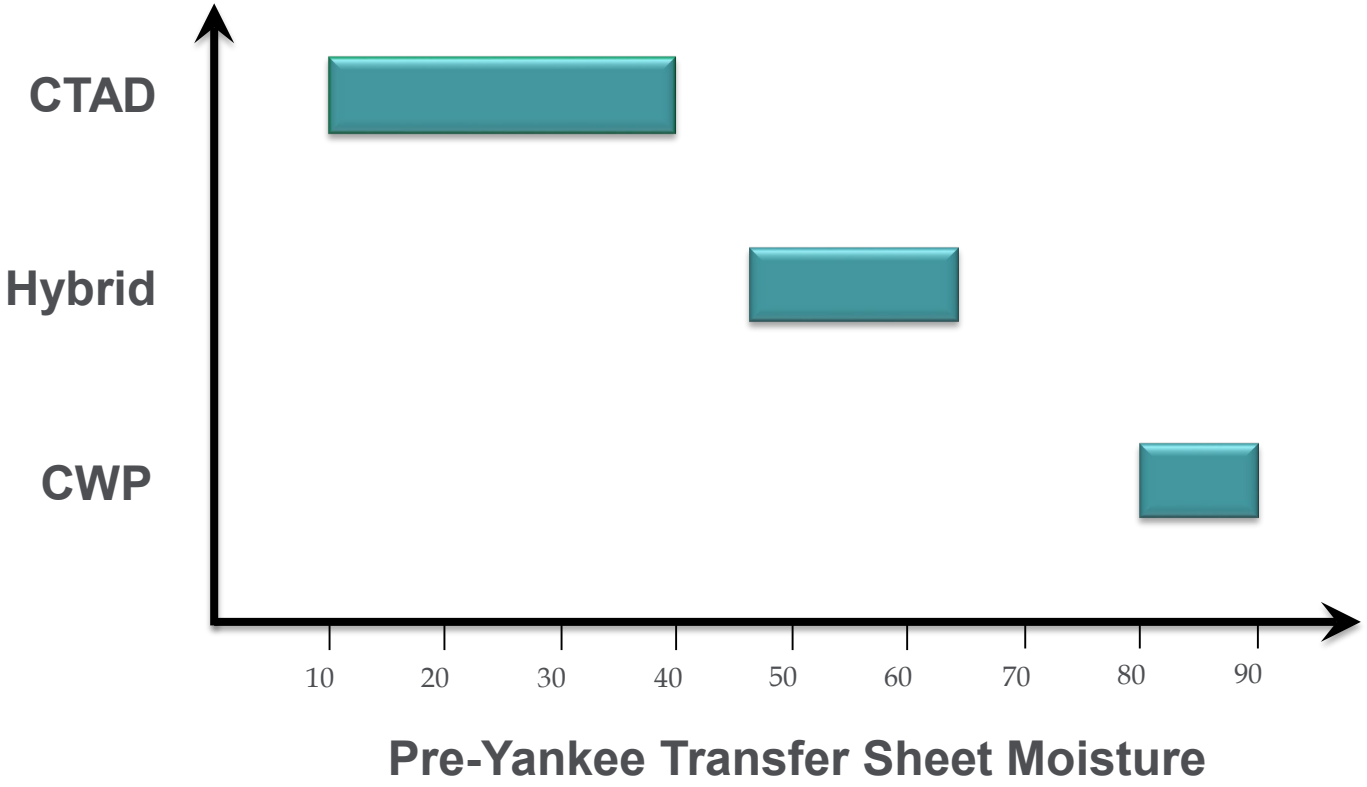
- Furnish
  - Dry lap
  - Slush pulp
  - Recycle
    - Ash content
  - Refining/Fines content
- Basis Weight (speed and moisture)
- Creping Moisture

- Wet End Chemistry
  - Strength Aids
    - Permanent wet strength
    - Temporary wet strength
    - Dry strength
  - Debonders/Softeners
  - Defoamers
  - Felt cleaners
  - Retention aids
  - pH



Impacts on YC Design – Machine Factors

- Machine Type – Yankee transfer moisture
  - Conventional wet press (CWP)
  - Through-air dried (CTAD)
  - Hybrid TAD



CWP – Crescent Former

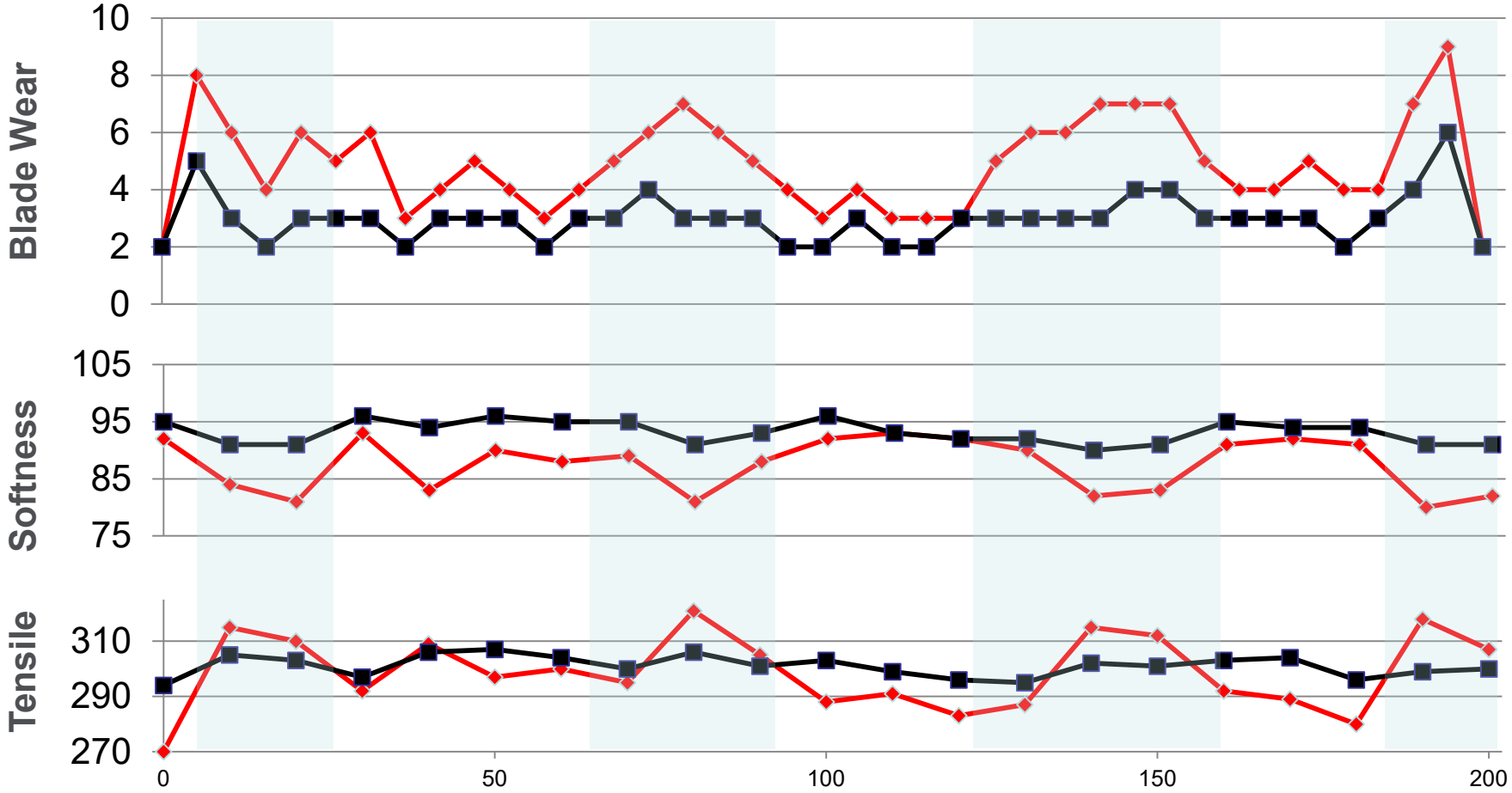
- Sheet moisture to Yankee 80-90%
- All furnish types
- Wide range of creping moistures

Picture courtesy of Valmet

CWP – Coating Considerations

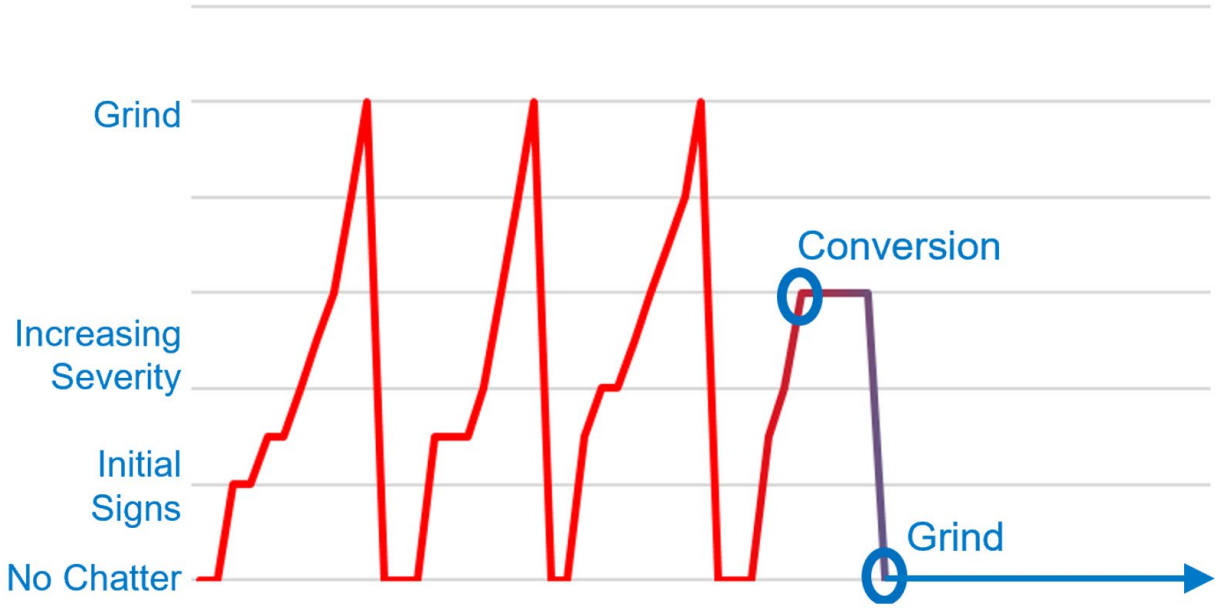
- Adhesive needs to be durable enough to withstand wet conditions at transfer to Yankee
- Adhesive needs to accommodate creping moisture
- Adhesive add-on of 1-5 mg/m^2 (flat sheet to Yankee)
- Humectant potential use at low creping moisture
- Both releases or modifiers can be used
  - Release for AFH higher creping moisture
  - Modifier for AH lower creping moisture
- Phosphate use dependent on water chemistry

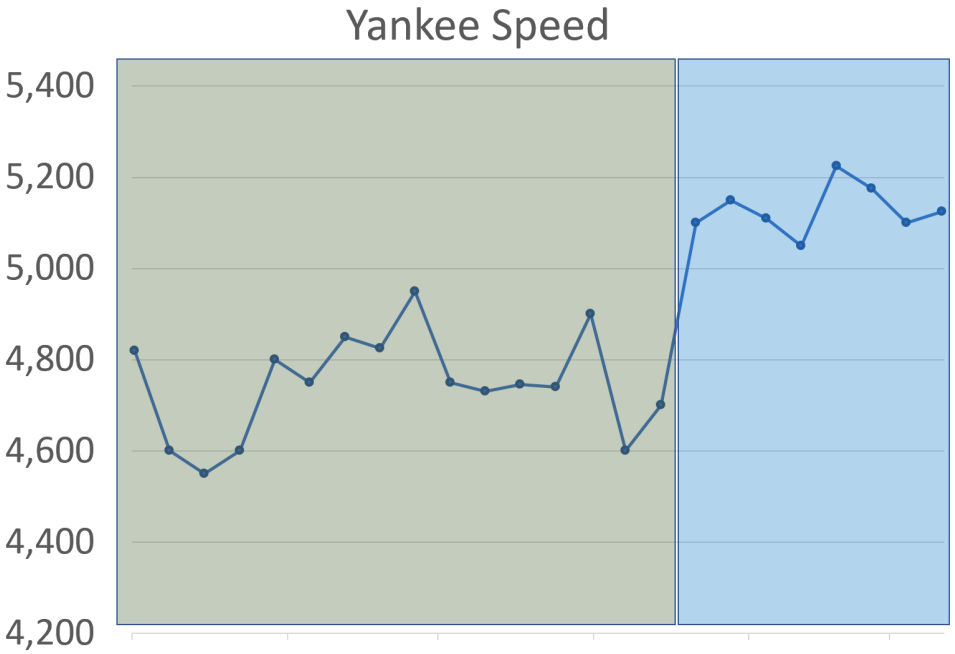
Driving Performance in Conventional

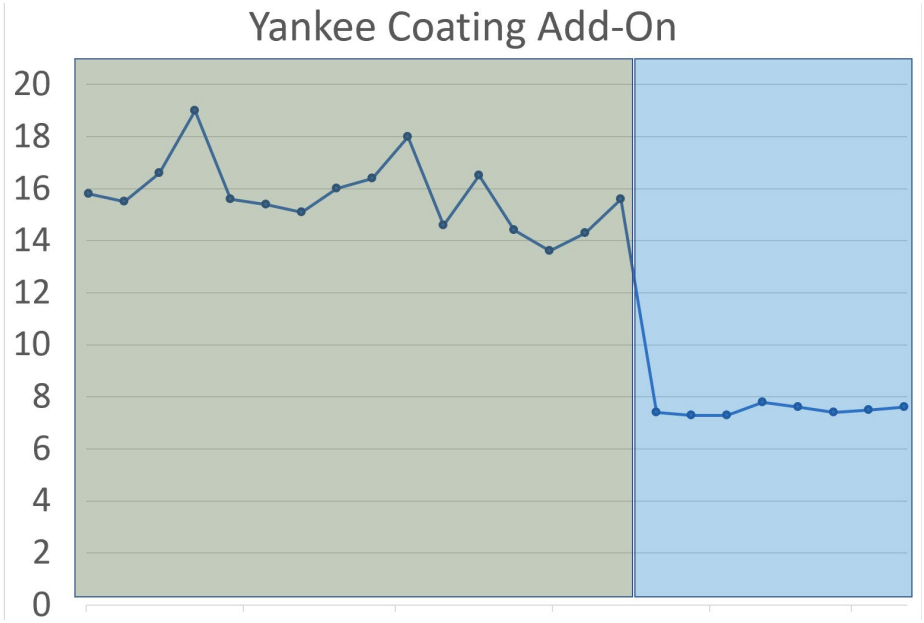


Driving Performance in Conventional

Dryer Protection, Productivity and Cost

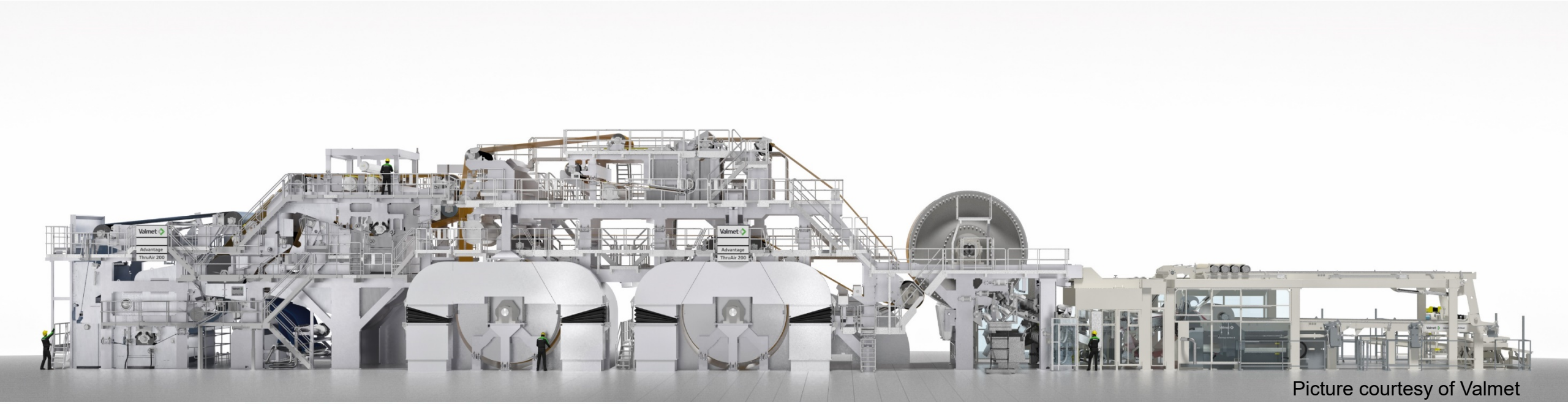






CTAD

- Sheet moisture to Yankee 10-30+%
- Virgin furnish
- Creping moisture < 5%

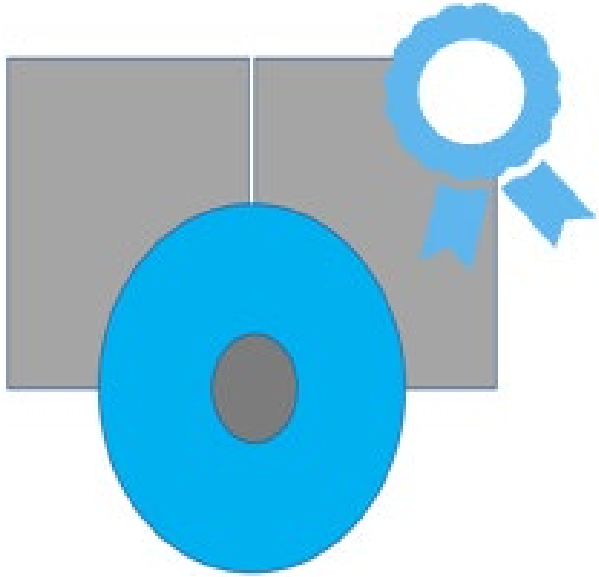


Picture courtesy of Valmet

CTAD – Coating Considerations

- Adhesive needs to provide wet tack adhesion to transfer the relatively "dry" sheet
  - Traditionally accomplished using a two-part adhesive program that includes PVOH
- Adhesive needs to build a thick enough layer to transfer the structured sheet with ~25% contact area (30-60 mg/m^2)
- Modifier typically used to soften and control film build; adjust durability
- Fabric release can impact coating film
- Humectant typical due to low creping moisture
- Phosphate use typically beneficial

Driving Performance in TAD

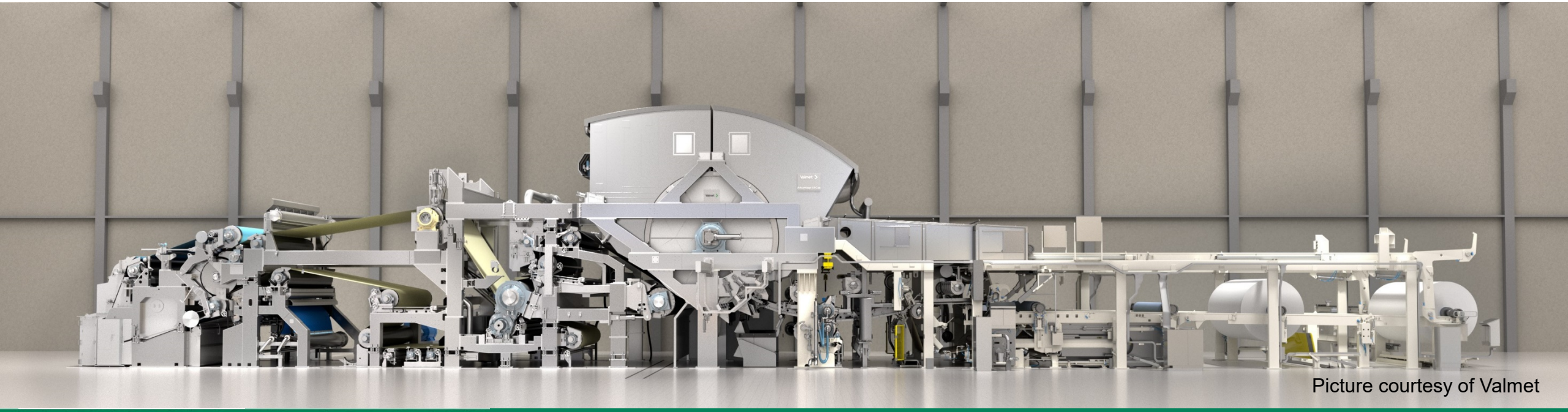


Towel Results	Before	After
Yankee Speed	4,250	4,500
Breaks per Day	14	10
Production	1.00	1.07
Creper Life	24 H	48 H
Cleaner Life	4 H	8 H

<u>Program Considerations</u>
Identical Coating Add-On
30% Reduction Release

Hybrid

- Sheet moisture to Yankee 46-64%
- Virgin or recycle
- Creping moisture ≤ 5%

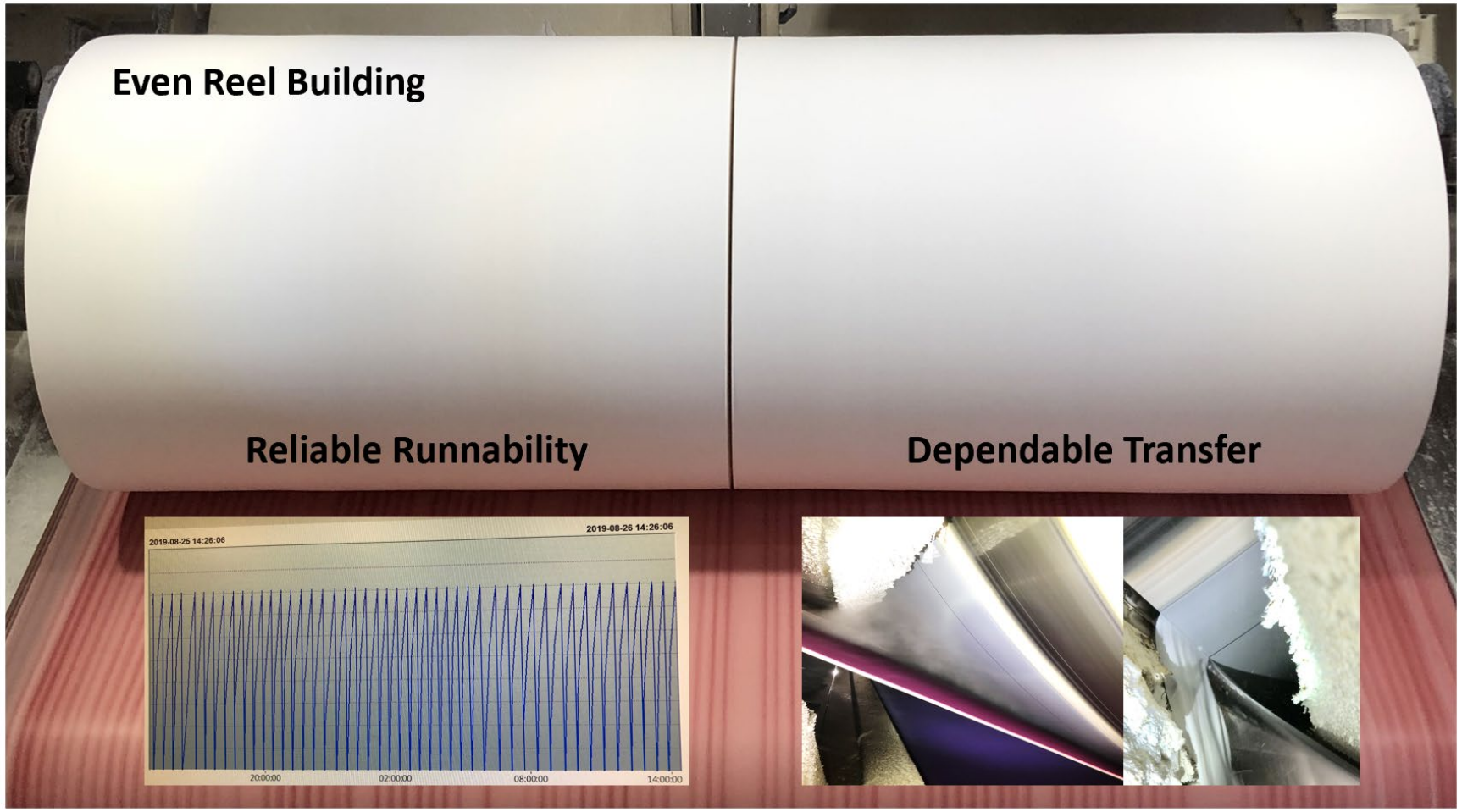


Picture courtesy of Valmet

Hybrid – Coating Considerations

- Due to newness of technology, coatings are in a dynamic phase of development
- Tend to be a hybrid of CTAD and CWP coatings
  - PVOH typically used
  - Need to accommodate both flat and structured sheets and virgin or recycle furnishes
  - Adhesive add-ons are in mid-range (20-30 mg/m^2)
  - Modifier or release can be used
  - Humectant and phosphate also used

Driving Performance in Hybrid



Summary

	Conventional	Hybrid TAD	CTAD
Transfer Moisture (%)	80-90	45-64	10-30+
Contact Area (%)	~100	~60	~25
Adhesive Add-on (mg/m^2)	1-5	15-25	30-60
PVOH Use	No	Yes	Yes
Modifier	Sometimes	Mostly	Mostly
Release	Mostly	Sometimes	Sometimes
Humectant	Sometimes	Mostly	Mostly
Phosphate	Varies	Varies	Mostly

Conclusions

- Coating design needs to accommodate machine type (operating conditions) and grade considerations (fiber and wet end chemistry).
- The coating supplier needs to provide a full range of adhesive platforms that can be tailored to machine type and grade.
- Equally important is a full range of other coating components including releases, modifiers, humectants and phosphates.
- Matching the correct coating to machine type and operating conditions drives enhanced and more consistent sheet quality and machine efficiency.

Thank you

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