

# Heatset drying problems

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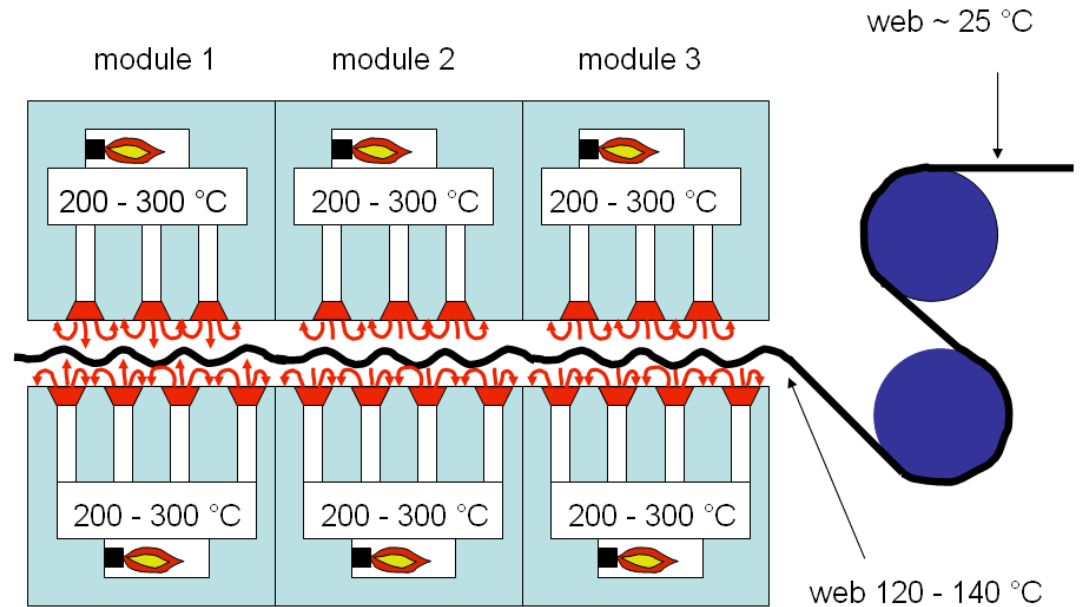
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# Heatset drying

- Problems associated with heatset drying
  - Smearing – ink transfer on unprinted area
  - Blocking – signatures dry together
  - Blistering – bubbles in print
  - Fiber roughening or fiber rising
  - Waviness or fluting or wrinkling
  - Cracking in fold

# Heatset dryer

- Delay in dryer 1 s at 200 – 300 °C air temperature
- Web temperature rises in 0,2 s over 100 °C
- Paper moisture content drops from 4 % to 0,5 %



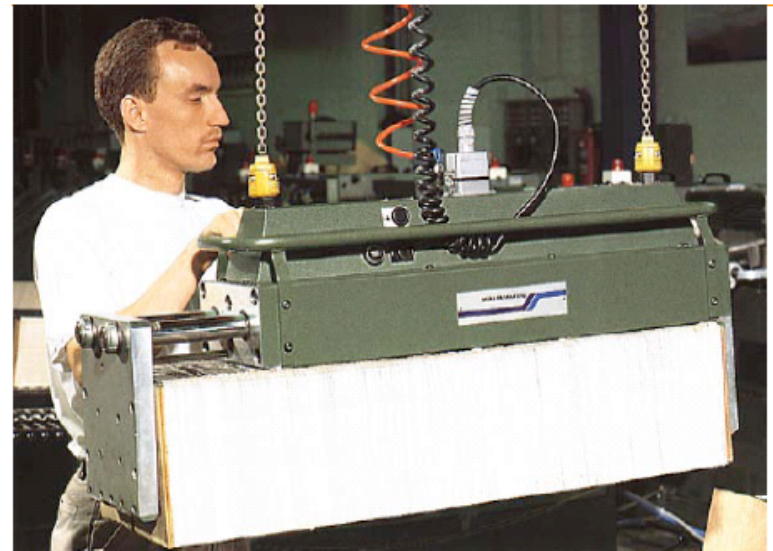
# Ink components affecting drying results

- Pigment
  - with higher pigment content lower ink demand and less solvent to be evaporated
- Binder
  - High solvent solubility to ink binder retards solvent evaporation
- Solvent
  - Low boiling point solvents evaporate faster
  - Vegetable oils harden slowly in oxidation process
- Waxes
  - Wax decreases smearing, blocking and rub-off risk

# Smearing and blocking

- Unwanted ink transfer
  - In chill rolls, folder in nips, bands, grippers, ...
  - pages block together (blocking)
- Usually the cause is too high solvent content in the print
  - insufficient drying
  - High paper moisture content
  - Ink properties

## Bundle feed



Müller Martini

# Blistering

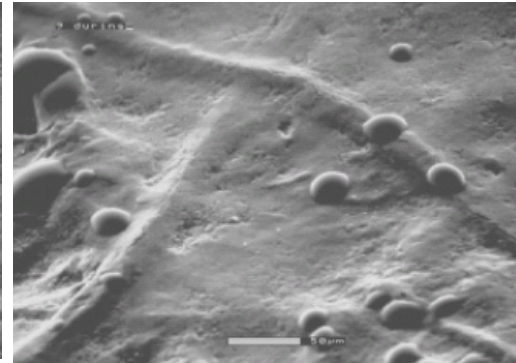
- Variables
  - Paper: moisture content, coating permeability and evenness of z-strength
  - Ink drying property and ink demand
    - Ink drying characteristics
  - Dryer settings and layout
    - Speed of web temperature increase
    - Heavy coverage on both sides of the web



# Fountain solution induced fiber roughening

LWC before wetting

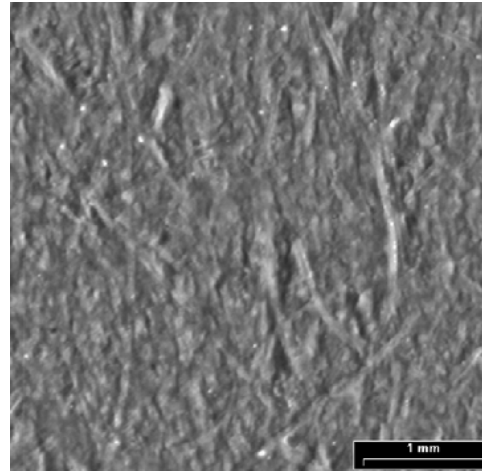
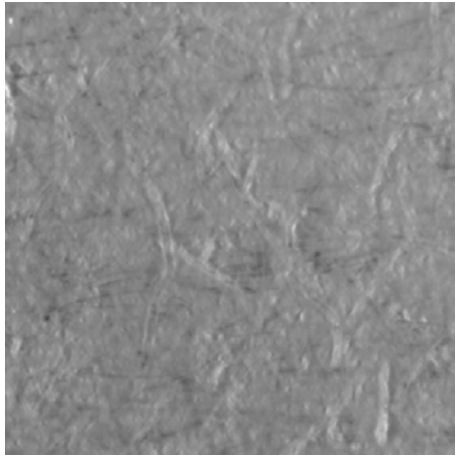
LWC after wetting



- Printing units: fountain water absorption
  - Fountain water penetrates through coating layer
  - Fiber collapse in calendering and decollapse in water contact



# Heatset drying induced roughening



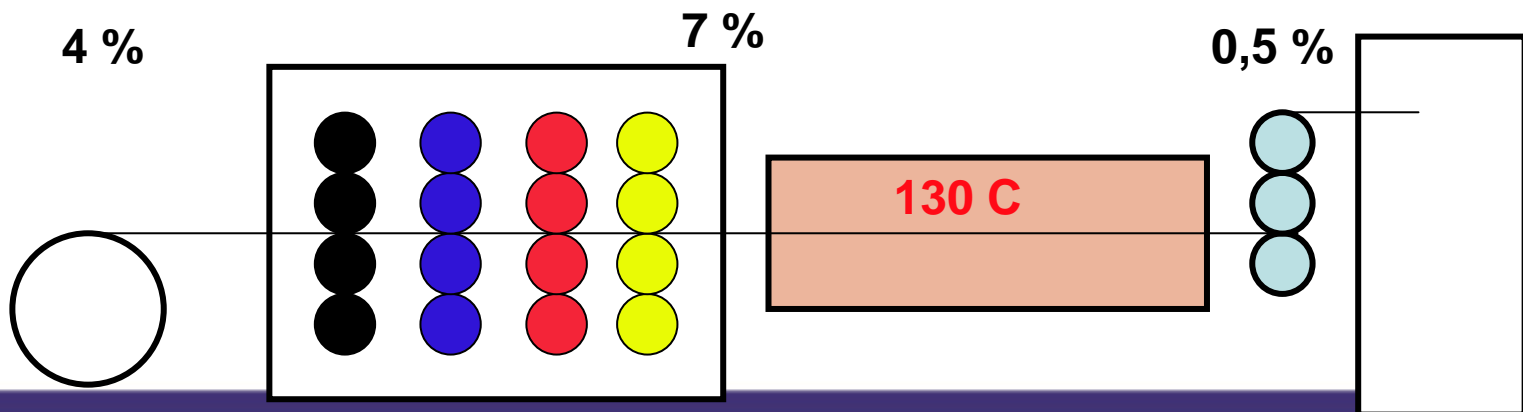
- Mechanism:
  - Fast moisture evaporation: high vapor pressure breaks fiber bonding
  - Mechanism similar to blistering
  - Prevailing mechanism

Pasi Puukko, KCL, Karhenema  
workshop 16.10.2003 Kemi



# Fiber roughening variables

- Coating layer properties
  - Low water absorption
    - good coating coverage, thick and dense coating layer usually reduces roughening
  - High coating permeation
    - thick and dense coating layer promotes blistering type of roughening



# Waviness

- 1. Moisture unevenness
  - moisture unevenness in printed paper due to changes in ink coverage
    - Uneven shrinkage
- 2. Web tension wrinkling
  - tension affects fiber bonding and causes permanent stretch
- 3. Ink solidifies wave pattern
  - Ink hardens in chill rolls and maintains the waves

fluting caused by heatset-drying



# Variables affecting fluting

- Paper
  - Even formation in X, Y and Z direction
  - High paper moisture content
  - High water absorption?
- Ink drying characteristics
- Web tension and drying temperature
- Layout

# Cracking in fold

- Base paper cracking due to reduced flexibility of fiber network at low moisture content
- Coating cracking due to lack of coating elasticity
- Drying temperature affect paper moisture content

# Paper moisture content

- Key paper component affecting drying result
- Quality factor
- Cost factor