

# SunChemical®

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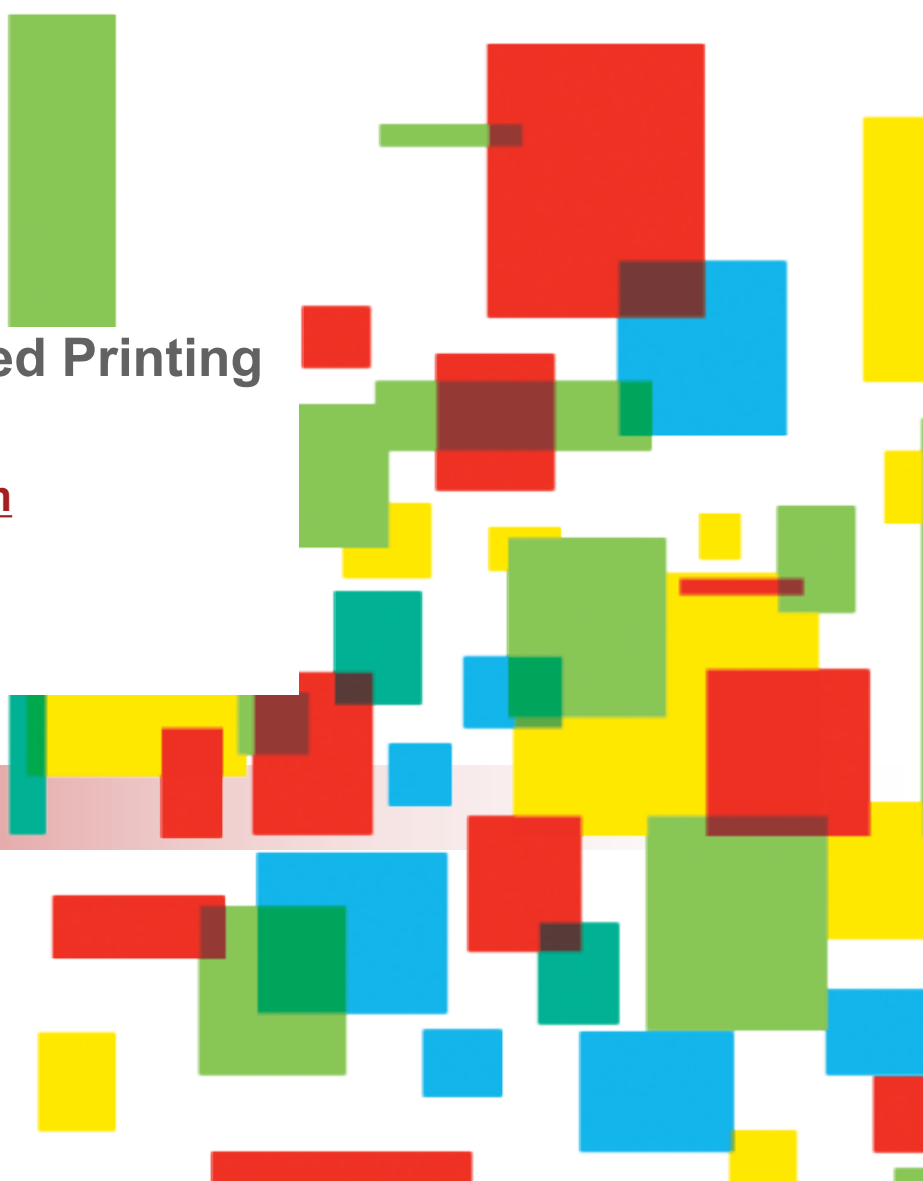


## Ink Developments for High Speed Printing

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**working for you.**

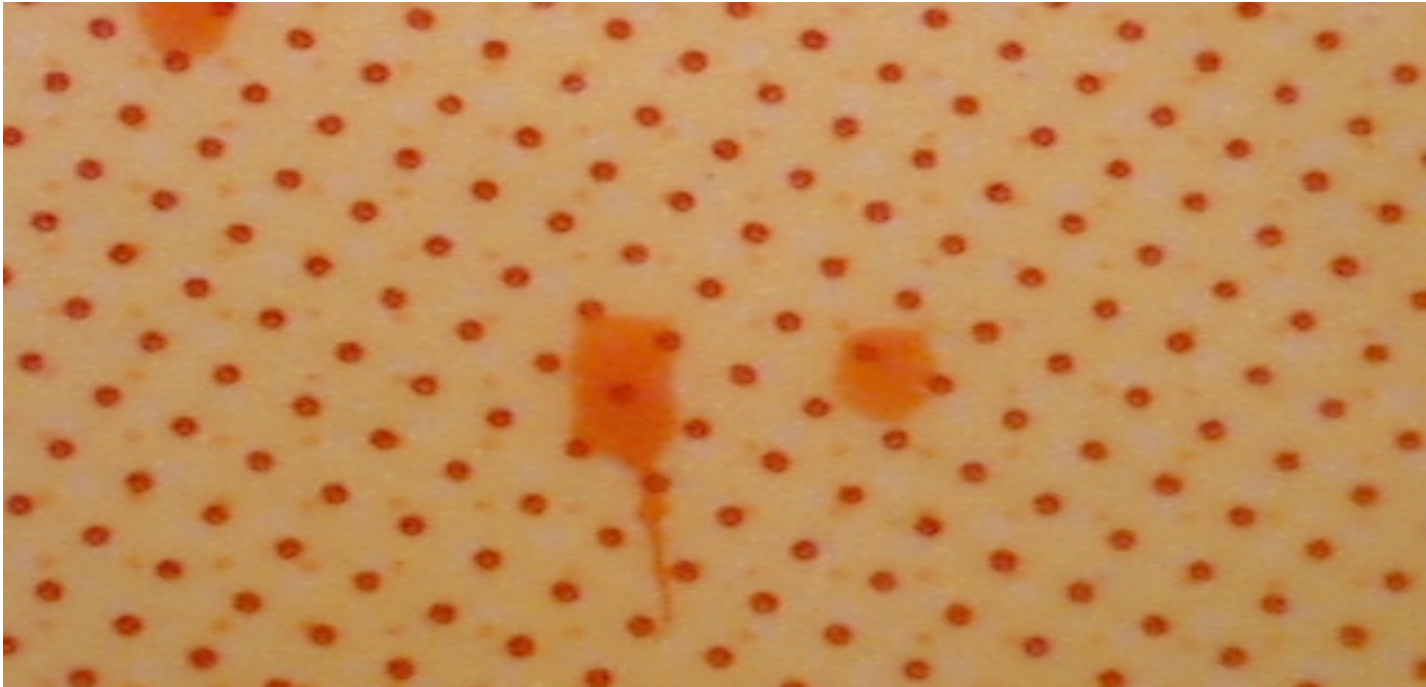


# Presentation Focus

- Flexo press speeds are increasing
- As press speeds approach and surpass 2000 FPM, the design parameters for inks change
- We will cover:
  - Typical defects seen
  - Why the defects are happening
  - Review basic changes needed for inks to successfully print at 2000 fpm and beyond
    1. Drying Speed / Stability
    2. Resolubility
    3. Ink Strength

# Defects

- What can happen when the press speeds increase?
  - **Dirty Print** – typically seen with large “clumps” of ink building up and transferring to print web



# Dirty Print Examples



Email: [naimarketing@sunchemical.com](mailto:naimarketing@sunchemical.com)

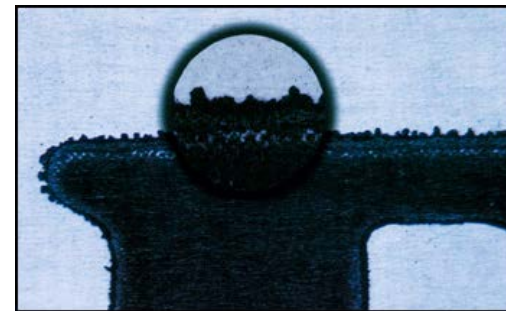
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# Defects

- Defects can also include:
  - Anilox plugging
  - Feathering on solids
  - Tracking / Ghosting
  - Misting



Ghosting



Feathering

# Why are the defects happening?

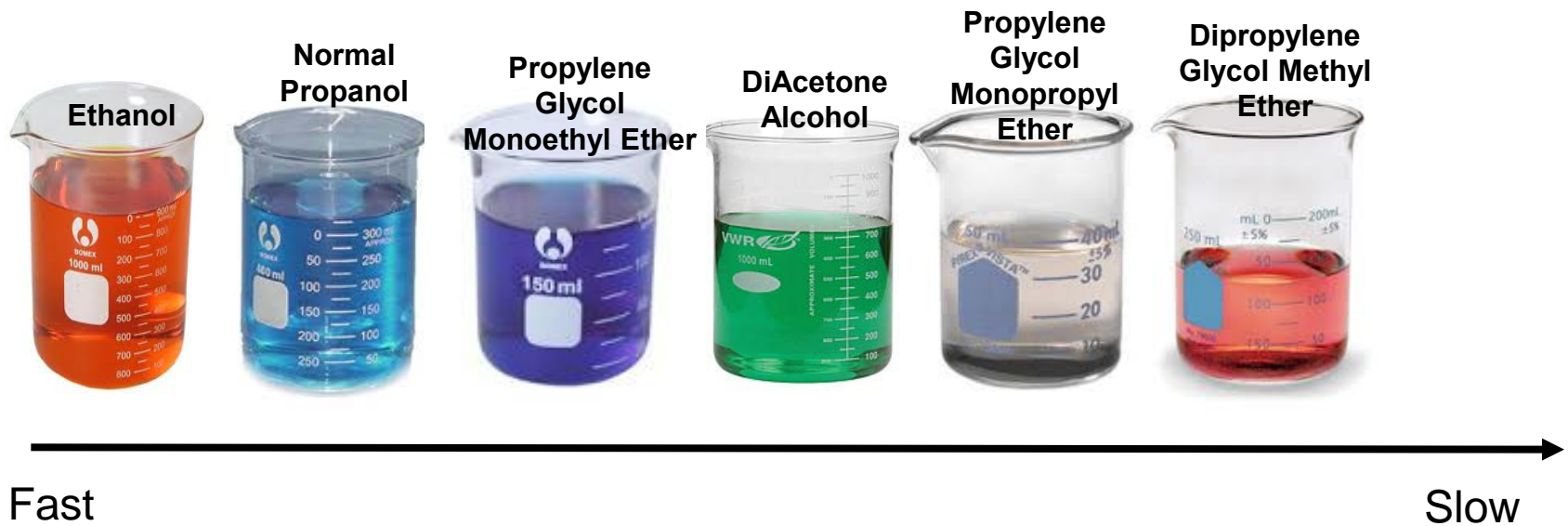
## Three main reasons:

1. Ink drying speed is not right
  - As the press speeds increase, the ink drying speed needs to be slower
  - Ink solvent blend is changing over time due to shear of high speed process
2. Ink resolubility is not good enough
  - With the high press speeds, ink will dry on plates and aniloxes
  - The ink needs to be resoluble to minimize the defects we reviewed previously
3. Ink needs to be stronger in color
  - Important as the stronger color will allow thinner ink films, which will minimize defects such as misting

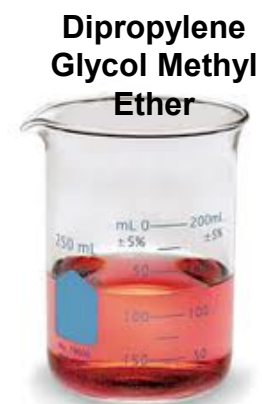
**Basic changes needed to improve ink performance**

# Ink Drying Speed

- “As press speeds increase...inks need to dry slower”
  - Historic inks that are based on ethanol are just too fast drying
  - Fast drying will lead to defects



# Solvent Selection

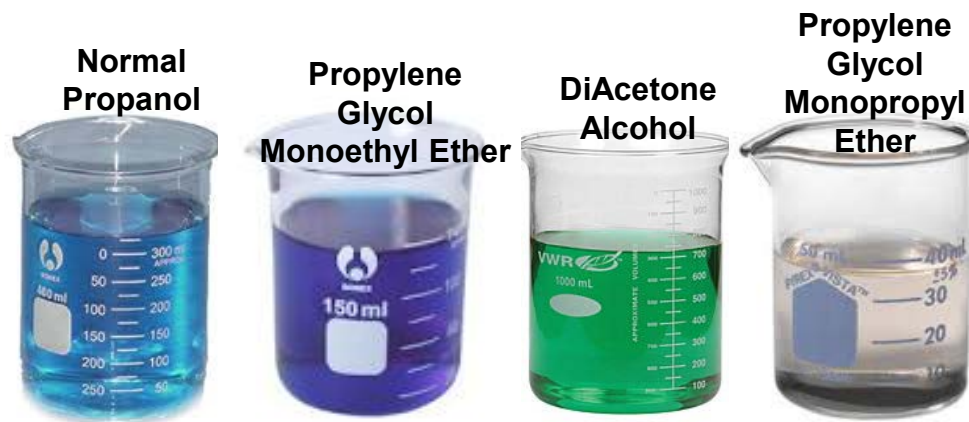


Fast

Slow



# Solvent Selection

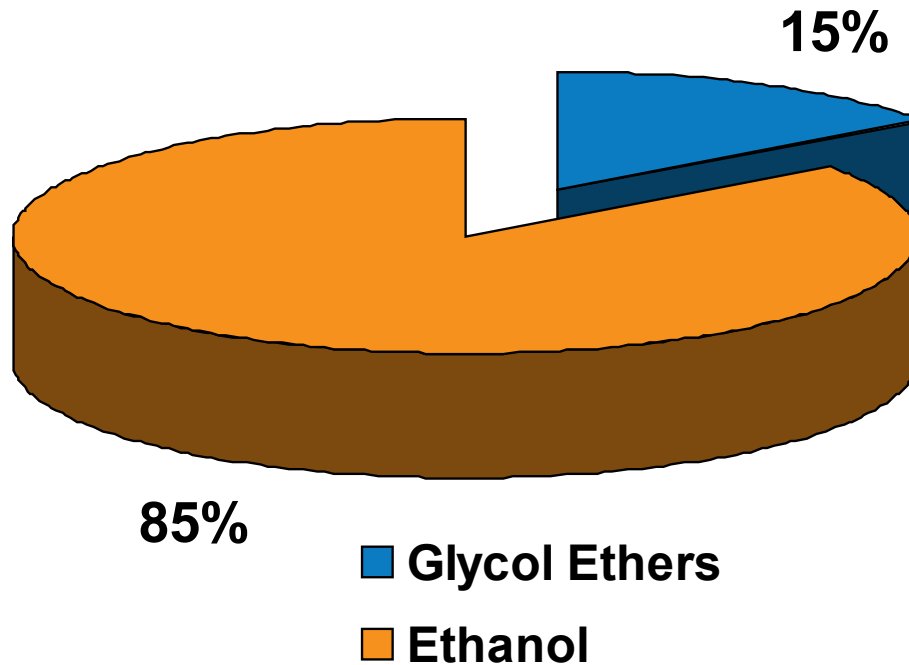


Fast

Slow

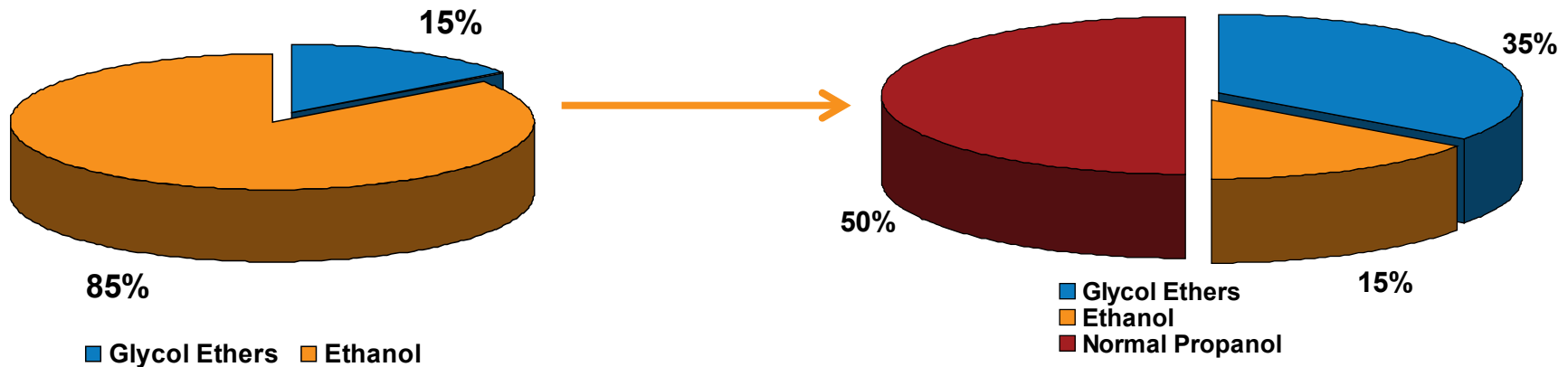
# Ink Drying Speed

- Changes in ink solvency for high speed printing – Flexo 2007



# Ink Drying Speed

- Changes in ink solvency for high speed printing from 2007 to 2012



As press speeds increase - the drying speed of the ink slows down

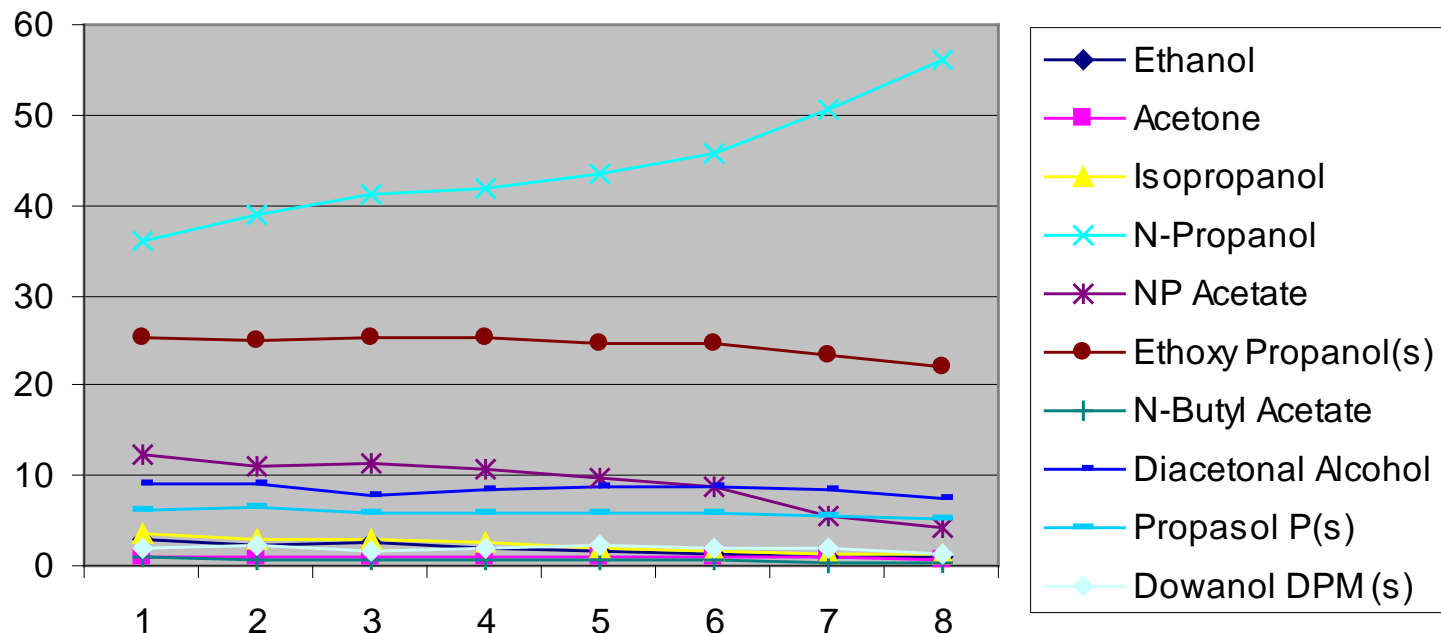
# Ink Stability

- Inks are typically not mono-solvent, but contain a mix of solvents such as:
  - Alcohols 10 - 90%
  - Acetates 10 - 25%
  - Glycols 0 - 90%
- High speed presses shear the inks more severely by exacerbating the volatility of the solvents
- It is very important that the ratio of these inks stay the same during the press run

**Changes in the solvents will lead to changes in ink performance**

# Ink Stability

- For high speed printing, the inks need to remain stable:
  - That is, the ink solvency should not change over time
    - Inks **work(s)** well for a set amount of time
    - But over a longer period the inks change and no longer work as well
  - Why?



Looks for these types of trends and fix

# Ink Resolubility

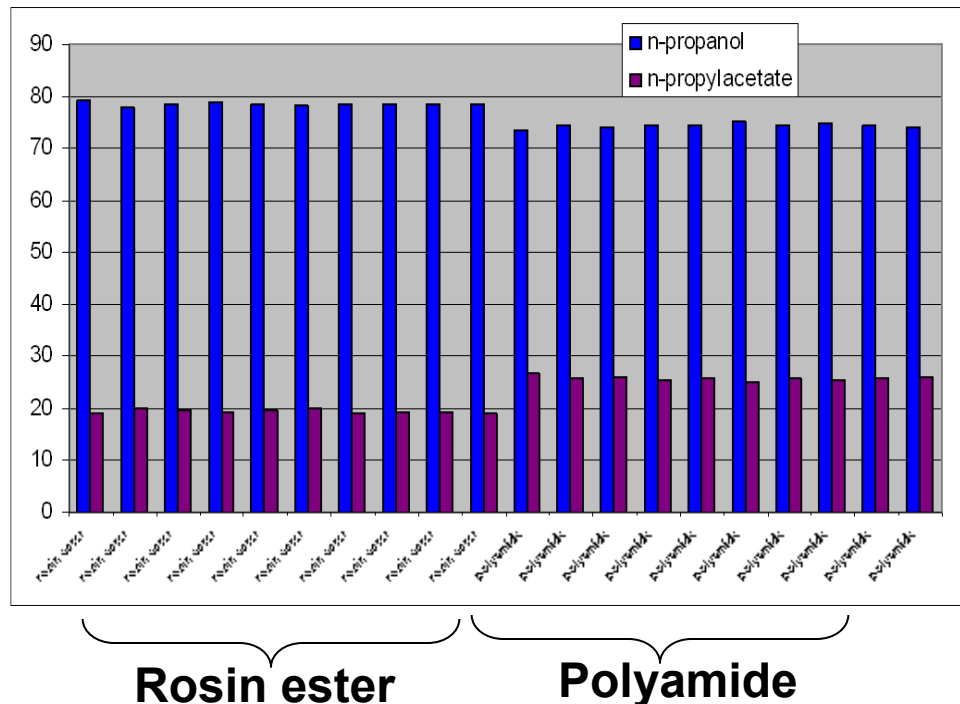
- Higher press speeds shear the inks more and stated previously:
  - **one** way **compensate** is to slow the drying speed of the inks
    - ...that's not enough....
- The inks need to have increased resolubility:
  - In the micro-seconds that the inks have to resolubilize—
    - Anilox – contact with ink in the doctor blade chamber
    - Plate – contact with ink in cells of **anilox**
  - The inks need to resolubilize or defects will occur:
    - Dirty print
    - Plugging
    - Feathering

# Resolubility in high speed flexo printing

## Solvent-Resin Interactions

Preferential solvent retention of any component of a solvent blend indicates resin-solvent interaction. Absorption equilibrium relates to resolubility, affinity of resin for a particular solvent

## HS composition of solvent blend above rosin ester vs. polyamide

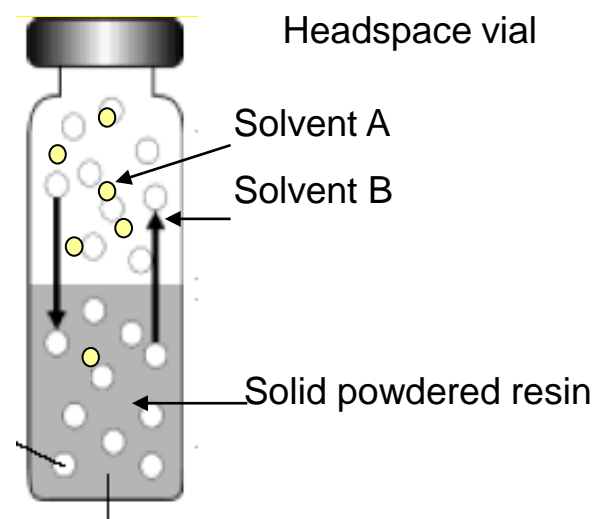


# Resolubility in high speed flexo printing

## Solvent-Resin Interactions

### Outcome:

- Difference in headspace composition above a rosin ester and polyamide spiked with a blend of alcohol and acetate:
- Polyamide selectively adsorbs alcohol, releases more acetate into headspace, is less tolerant of acetate compared to rosin ester.
- Polyamide should be more readily resolubilized in a blend proportionally higher in alcohol; a higher proportion of acetate should favor resolubility of rosin ester.



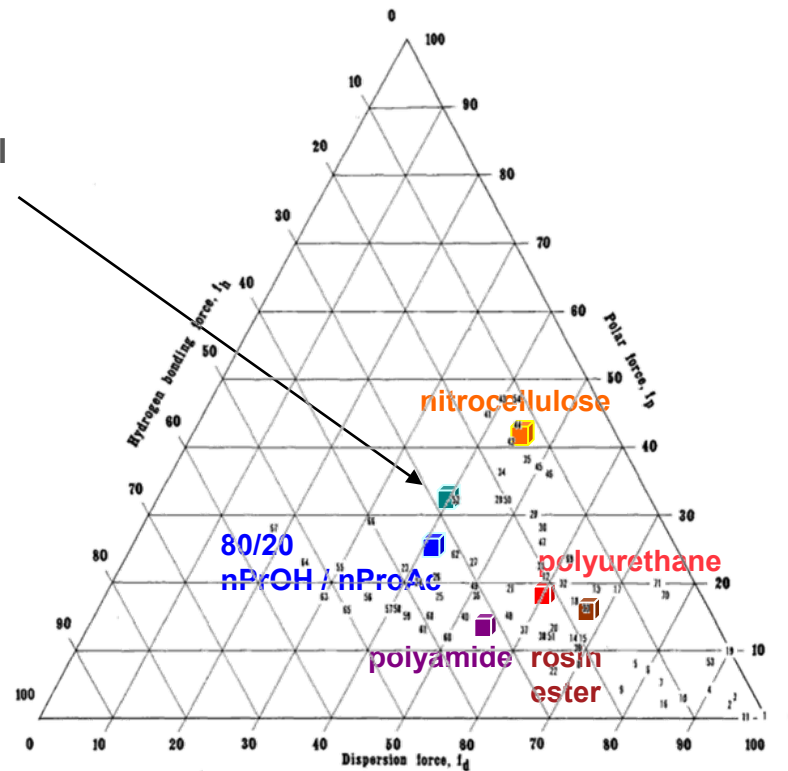


# Resolubility in High Speed Flexo

**Objective:** Match solubility parameters  $\delta$  of polymer and solvent to improve high speed flexo print quality

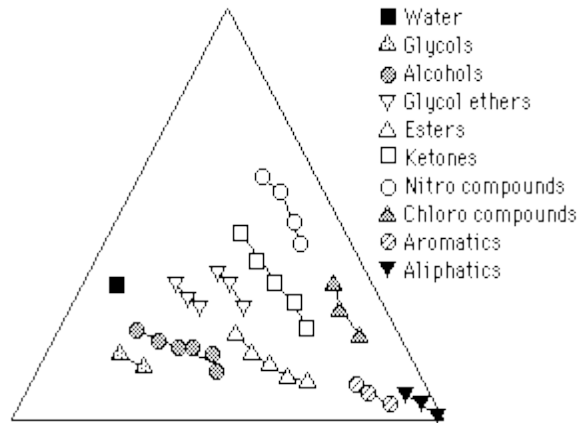
Solvent blend:

- Propasol P
- diacetone alcohol
- ethoxypropanol



Teas graph: map of  $\delta_{POLAR}$ ;  $\delta_{DISP}$ ;  $\delta_{H-BONDING}$

# Resolubility in High Speed Flexo



## Premise:

- Dynamic resolubilization of ink resins on the anilox depends upon print speed and solubility parameters  $\delta$  of polymer and solvent.
- Poor match ups will contribute to dirty printing due excessive drying in the anilox or poor bond strength for lamination to undesired retention of solvents.
- The solubility parameter is related to the cohesive energy density – in turn related to dispersive, polar, and hydrogen bonding forces

- Inks re-formulated to have:
  - A wider solubility parameter “window” so that the resin solubility are not as sensitive to changes in the solvency
  - Changes in the ink solvency to better balance inside the solubility parameters
  - Inks designed with the widest solubility parameters. If the resin is more soluble, then less slow solvent is needed. Ink will better resolubilize on the plate and anilox

# Ink Color Strength

- As press speeds increase, typically the anilox volumes must decrease
  - If deeper aniloxes are used (above ~6.0 BCM) defects can occur such as:
    - Misting
    - Dirty Print
  - The delivered color strength must be the same, i.e., target densities and matched colors
  - Therefore , the ink strength needs to be higher. Using finer aniloxes to get the same color strength requires a stronger ink to be used

High-Speed Printing

SunSpectro® Sunsharp

**SunChemical**<sup>®</sup>

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Color  
Strength

Inks and  
Coatings

Flexographic