Printing Ink Technologies for Shrink Sleeves

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Agenda

- Introduction
- Different ink types and printing technologies
- Typical ink ingredients
- Requirements for the inks for shrink sleeves
- Tips for water based and solvent based printing
- Deep dive into UV curable inks
- Summary

Role of packaging

protection - increase of shelf life

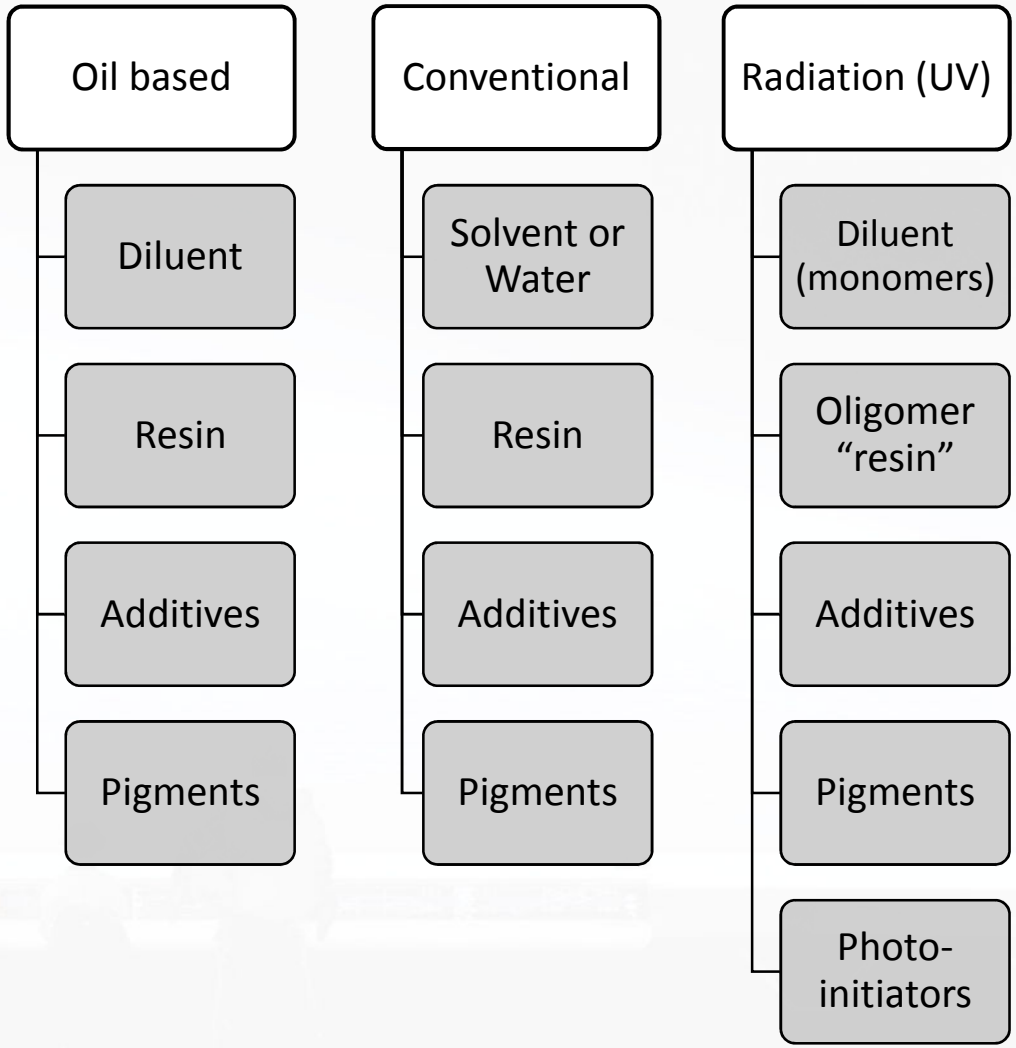
Brand Recognition

Eye Catching Packaging

Attractiveness of shrink sleeves

- Eye catching
- Possibility to differentiate (360° info)
- High quality printing
- High resistance (scratch & chemical) properties
- Food safety

Different ink types and printing technologies



Different ink types and printing technologies

Print method	Ink type			
	Solvent-based	Water-based	Oil-based	UV-curing
Flexo	X	X		X
Letterpress			X	X
Offset			X	X
Screen	X			X
Gravure	X	X		
”Digital”	**X**	X	X toner	X

Typical ink ingredients

Ingredients	Ink types			
	Solvent-based	Water-based	Oil-based	UV curing
Pigments	Yes	Yes	Yes	Yes
Resins	Nitrocellulose	Acrylic	Phenolic Alkyd	Oligomers
Diluents	Solvents	Water/amine	Mineral / Vegetable Oil	Monomers
Solvents	> 30%	< 5%	0	0
Additives	Wax Antifoam Silicones Plasticizers	Wax Antifoam	Wax Stabilizers Fillers	Wax Photo initiator Stabilizers

Pigments

- Pigments
  - physically & chemically stable
  - non-soluble
- Denoted by Color Index Number (CI#)
  - Red 57.1, Red 184, Red 177
- CI# indicates properties
  - hue, fastness, cost….
  - important to know CI#!
- Organic nature
  - Pyrazolene, Disazo, Naphthol, Pthalocyanine, Quinacridone
- Inorganic
  - Titanium Dioxide
  - Iron Oxides
  - Metallic

Resins

- Typical resins used
  - Nitrocellulose
  - Polyamide
  - Acrylic (styrene and acrylic acid)
  - Phenolic
  - Epoxy Acrylates, polyester acrylates, etc…: used in UV/EB inks & coatings
  - Urethanes, Polyesters: used in solvent based inks & coatings
- This is the backbone of the ink!
- Will affect adhesion, flexibility, resistance properties, speed of drying/curing, and overall end performance of printed material

Diluents

- Used to reduce viscosity, to “thin” the ink
- Most common is H_2O for waterbased inks
- UV inks use monomers
- Diluents will affect dry/cure speeds also

Additives

- Defoamers
- Waxes/Silicones (Coefficient Of Friction=COF)
- Matting agents
- Photoinitiators for UV inks
- Adhesion promoters
- Surfactants
- Optical Brighteners

Requirements for inks for shrink sleeves

- Very high color strength
- High cure speed
- Excellent press & print performance
- Ability to shrink (so flexibility !)
- Adhesion to wide range of substrates (PET-G, PVC, OPS, PLA,….)
- Good surface slip properties, especially for ink on the last printing station (usually white)

Why is white ink so important?

- Usually last down so COF is very important
- Scratch resistance, adhesion and flexibility
- Opacity, adhesion and flexibility
- Low COF (high slip) – last down
- High COF (low slip) – first down
- Some people will print single bump of white and up to 3 bumps to get opacity and performance

Tips for printing water based inks

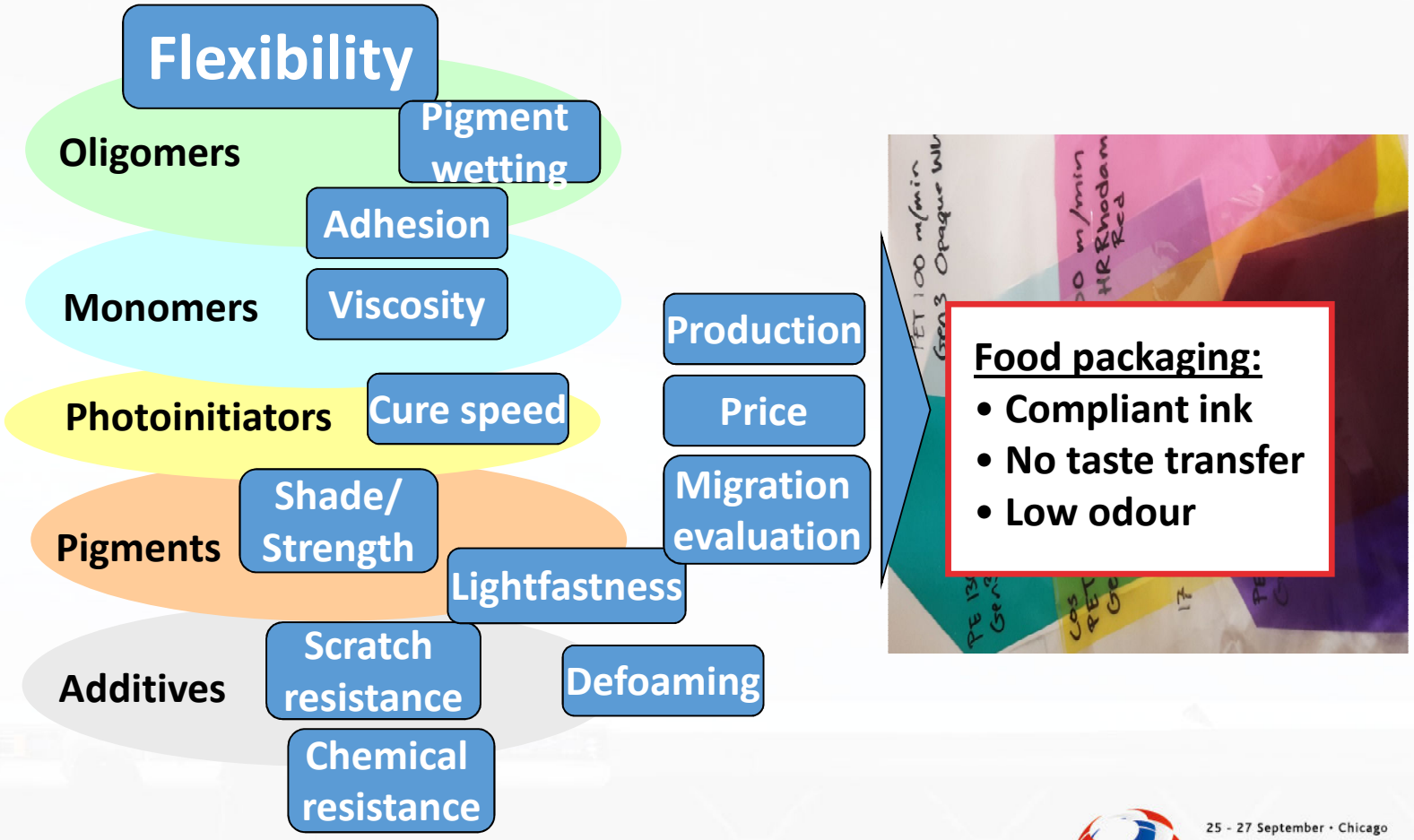
- Proper anilox roller selection and press speed
- Ensure proper drying in order to reach the desired properties (adhesion and scuff resistance) as well as to prevent blocking in the rewind
- Catalyze the inks (whites/last down) if steam tunnel is used for shrinkage
- pH maintenance is critical!

Tips for printing solvent based inks

- Correct solvent selection is important as some solvents like e.g. acetates damage the film, leading to e.g. whitening

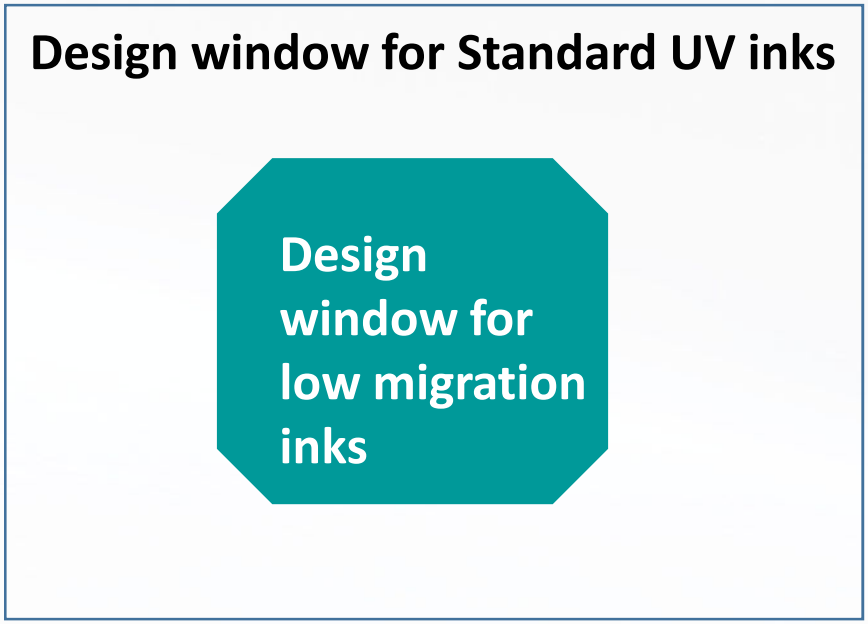
- No retained solvent in inks after drying as this can affect shrink performance, so a combination of proper air drying with right viscosity is important

Deep dive into UV inks: designing a Low Migration UV flexo ink



Designing Low Migration UV flexo inks

- Less building blocks available
- Excluding low molecular weight monomers prone to migrate
- Legislations and regulatory environment continuously moving
- Increased awareness among local brand owners



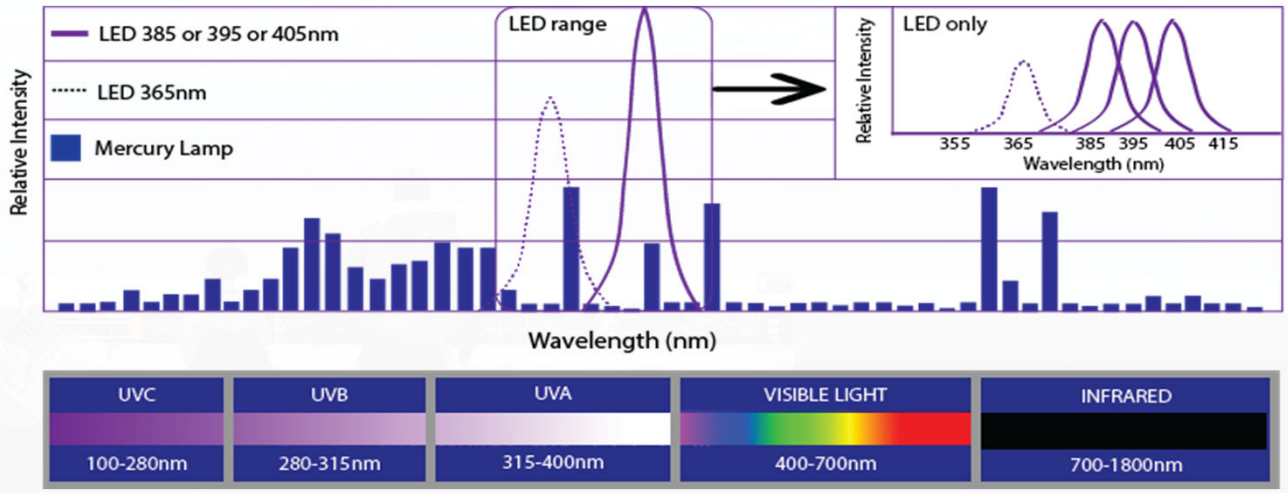
Targeting a design window that gets smaller every year

Challenges with UV curable inks

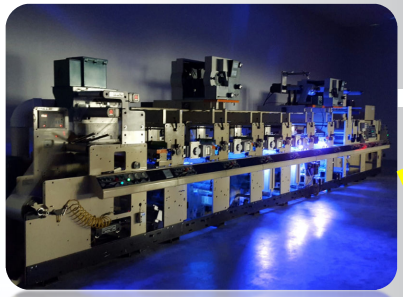
- Heat generation from UV lamps will distort films, especially thin films
- If you don't have the proper ink formulated for "cool UV" systems, then your UV inks may not cure as fast…….
- Often the chill roller is too cool
- All of these challenges can be addressed…….with UV LED curing

What is UV LED?

- UV LED means UltraViolett Ligth Emitting Diode
- UV LED is an alternative for the tradiotional UV Hg lamp systems (different wavelenght and intensity compared to conventional UV)
- Different ink chemistries are needed



Advantages of UV LED curing



IDEAL for Shrink Sleeves

Performance	• High color strength with excellent cure • Reliable and consistent adhesion and printability • Dual cure
Advanced Capabilities	• Useful [illegible]at sensitive films, thin [illegible] [illegible]ed and controlled curing intensity - [illegible]consistent curing

Operating Economics	• Higher Productivity
	  • Press UPTIME – less equipment faults
	  • Faster cure
	• Energy Efficient
	• Long Lifetime & Low Maintenance
	• Solid State: Instant on/off

Health and Environmental	• Mercury & Ozone Free • Less Heat and Operating Noise

Summary

- Shrink sleeves allow to make eye catching packaging and labels
- Inks are an important part of the shrink sleeves
- Requirements for the inks for shrink sleeves are quite stringent
- Not all inks will fit…….they must be specially designed and tested to achieve those performance requirements