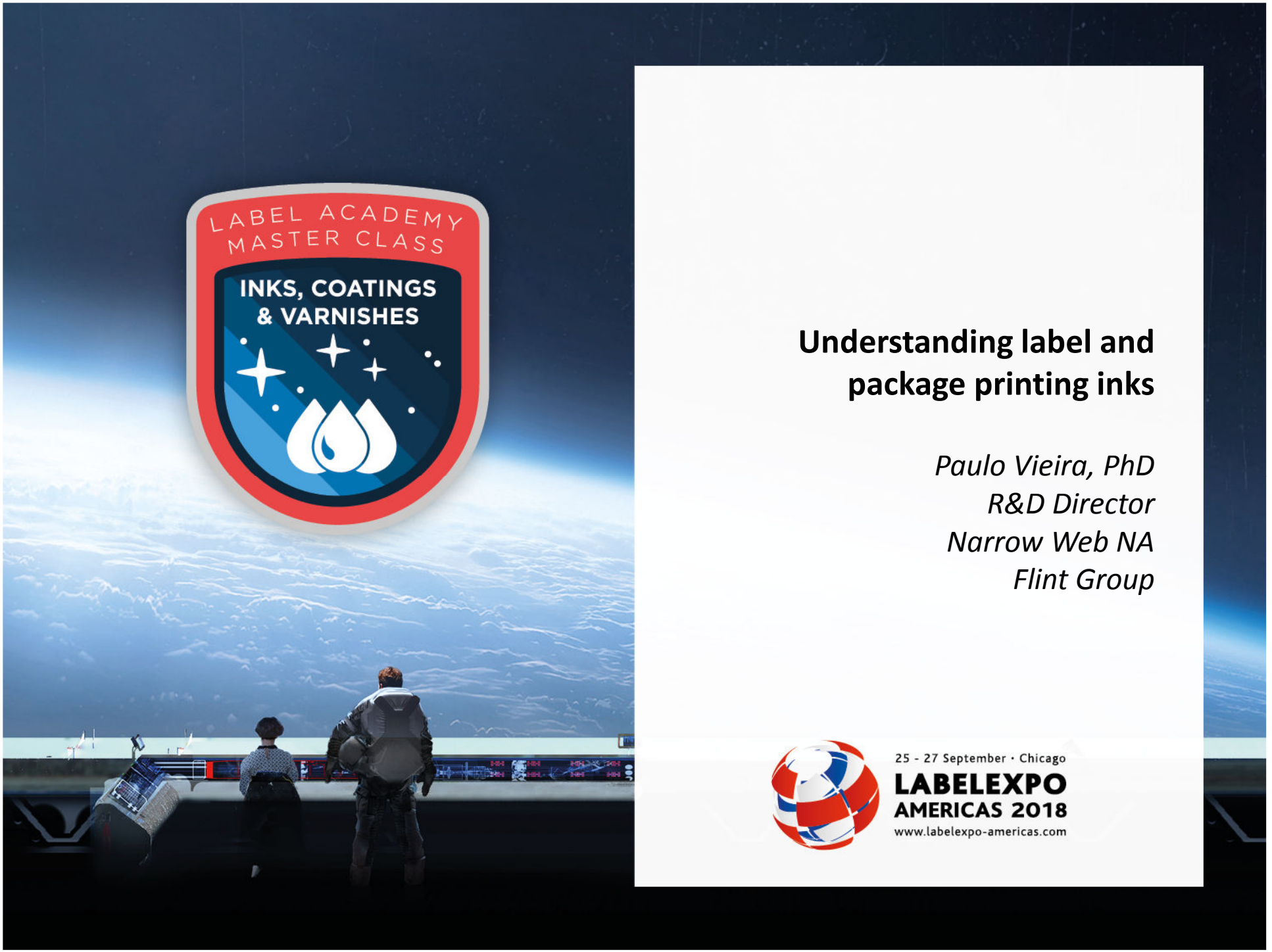

Understanding label and package printing inks

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www.labelexpo-americas.com

Agenda

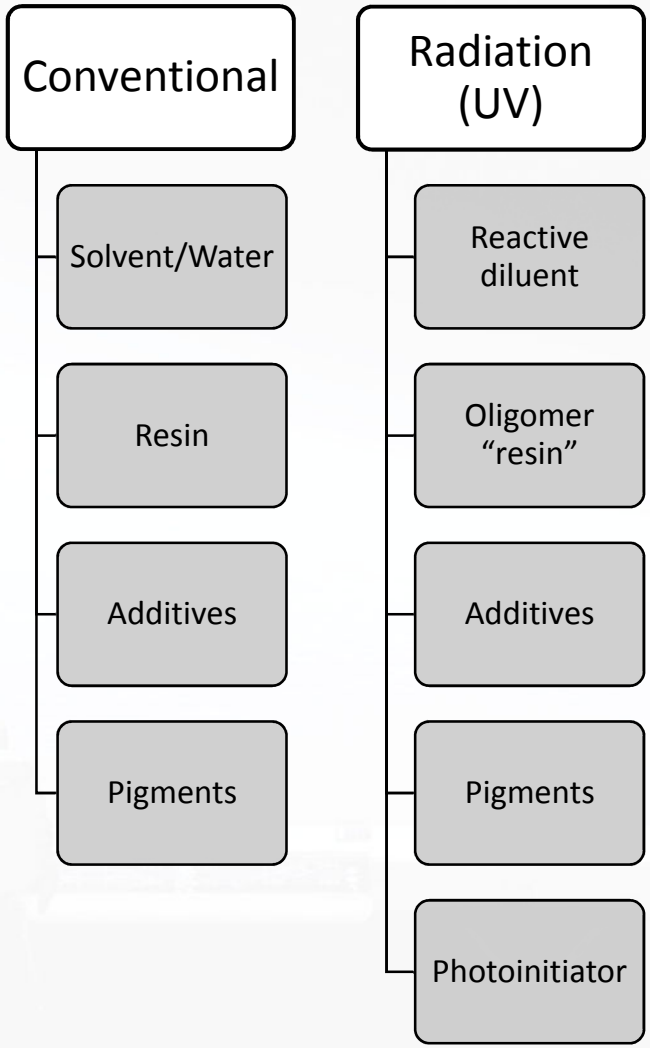
- Inks Composition and Process
- Printing Processes
  - Press types
- Inks Interaction with substrates

Inks Composition and Process

- Types of ink
  - UV
  - Waterborne
  - Solvent borne

Inks Composition and Process

UV inks - Differences in composition vs conventional inks



Inks Composition and Process

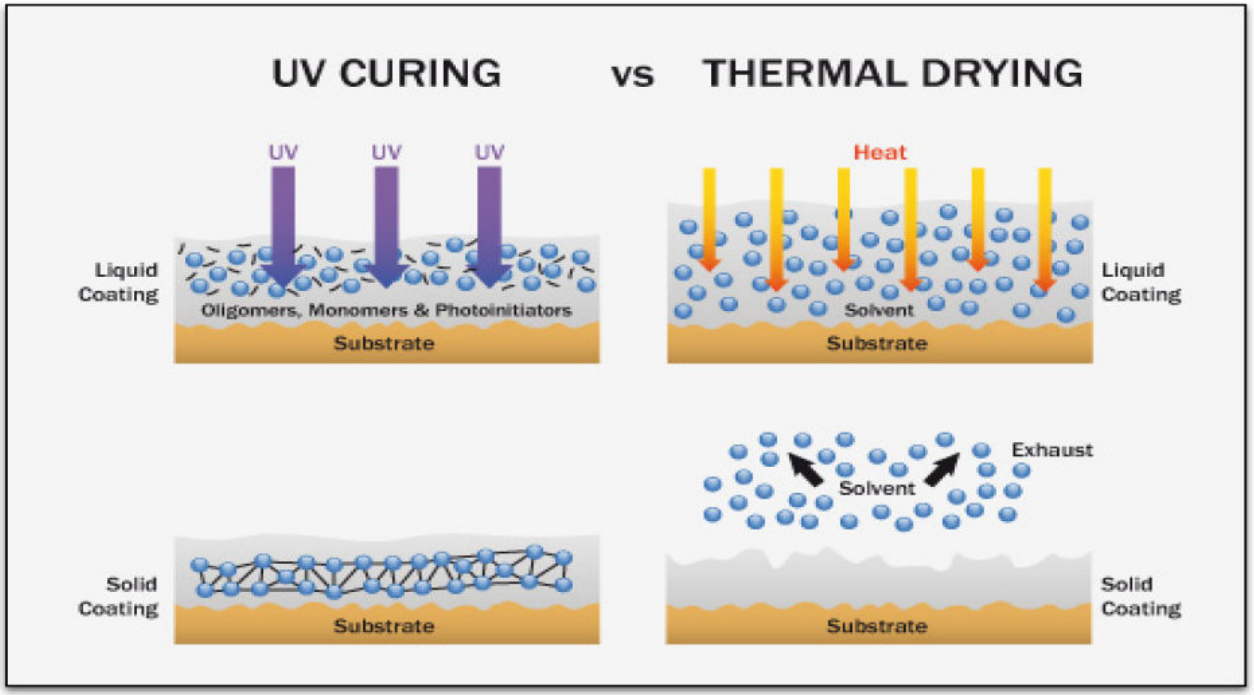
Curing mechanisms

Drying
(physical laydown)

- Water Evaporation
- Solvent Evaporation

Curing

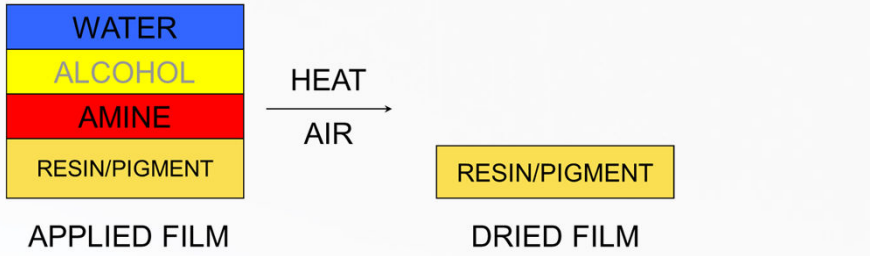
- Radiation (UV, LED, EB)
- Termal (Oven, IR)
- 2K (Epoxi, Urethane X-link)
- Chemical (Moisture, Oxidation)

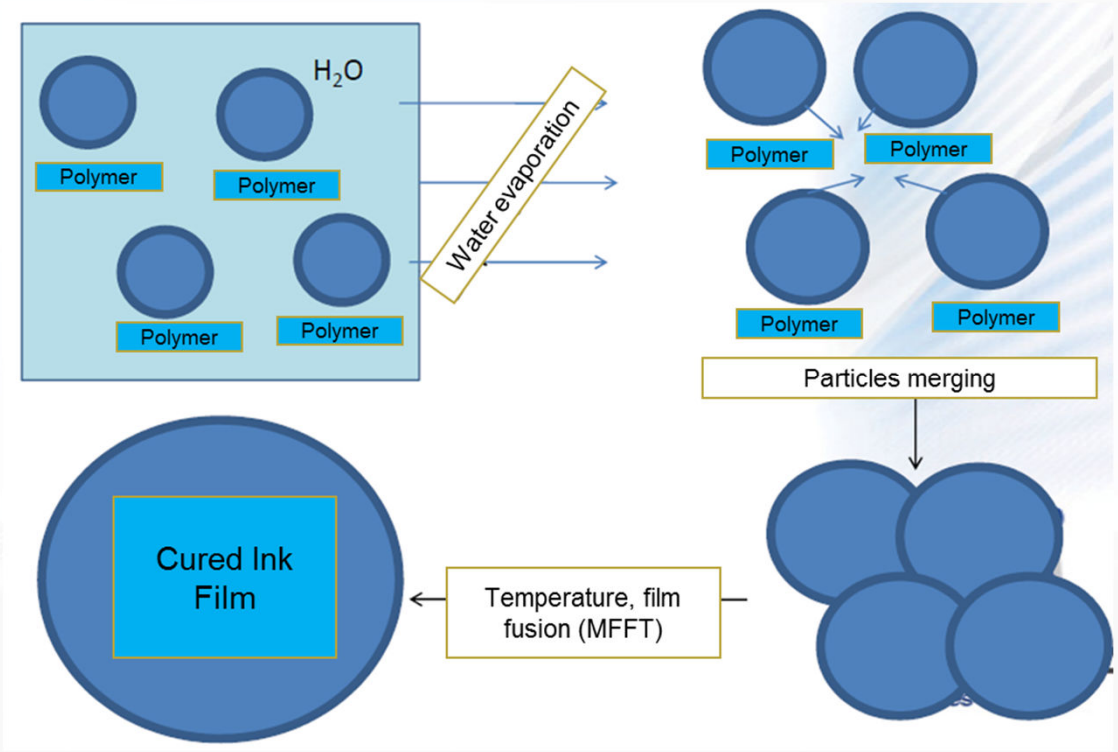


Inks Composition and Process

Waterborne - Coalescence

Different from Solvent based inks, not only evaporation and physical laydown.

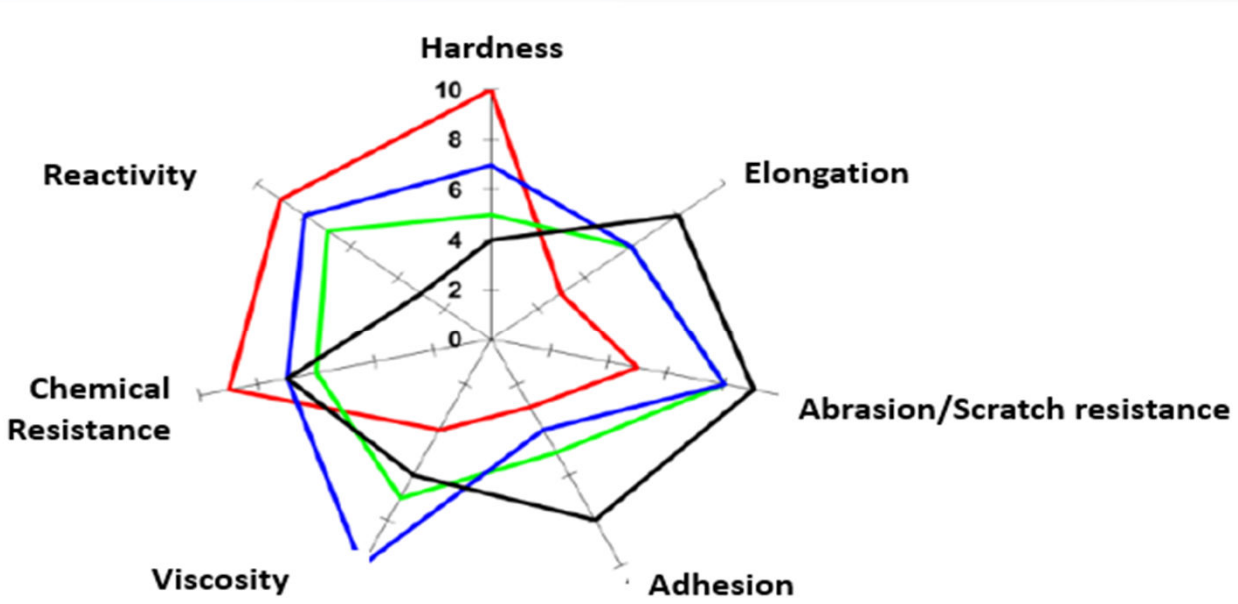




Inks Composition and Process

Oligomer

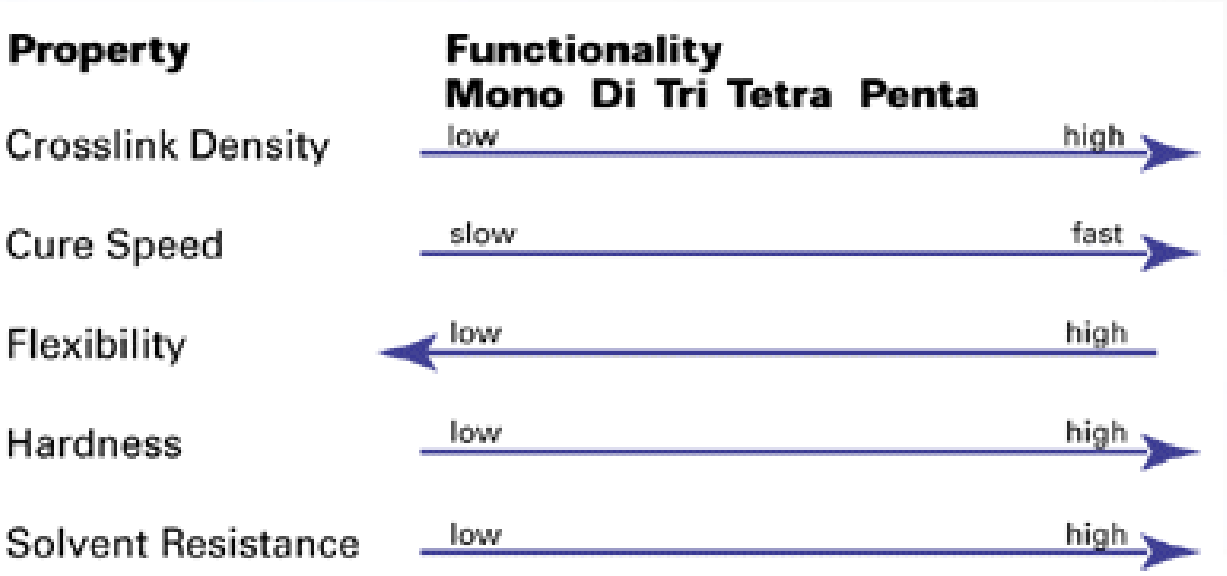
- *The real "backbone" of any UV ink system (the resin).*
- *It helps in the pigment wetting, transfer and provide other important properties to the ink film. Many Functionalities available*



Inks Composition and Process

Monomers

- *Used to reduce viscosity, "thin" the ink*
- *Monomers - low molecular weight reactive compounds*
- *Can affect adhesion, flexibility, end performance*

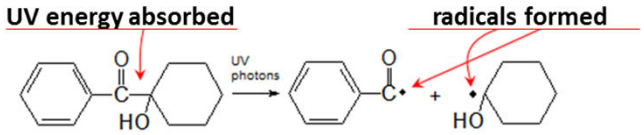


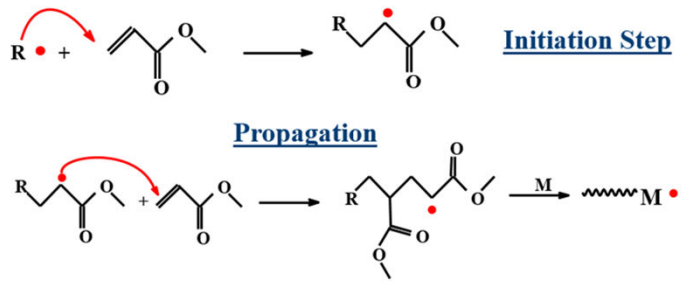
Inks Composition and Process

Photoinitiators

- *The KEY to the UV curing process!*
- *Determines the curing ability of system*
- *Different types used, blended, depending on type of lamp, pigment composition and process/print requirements.*

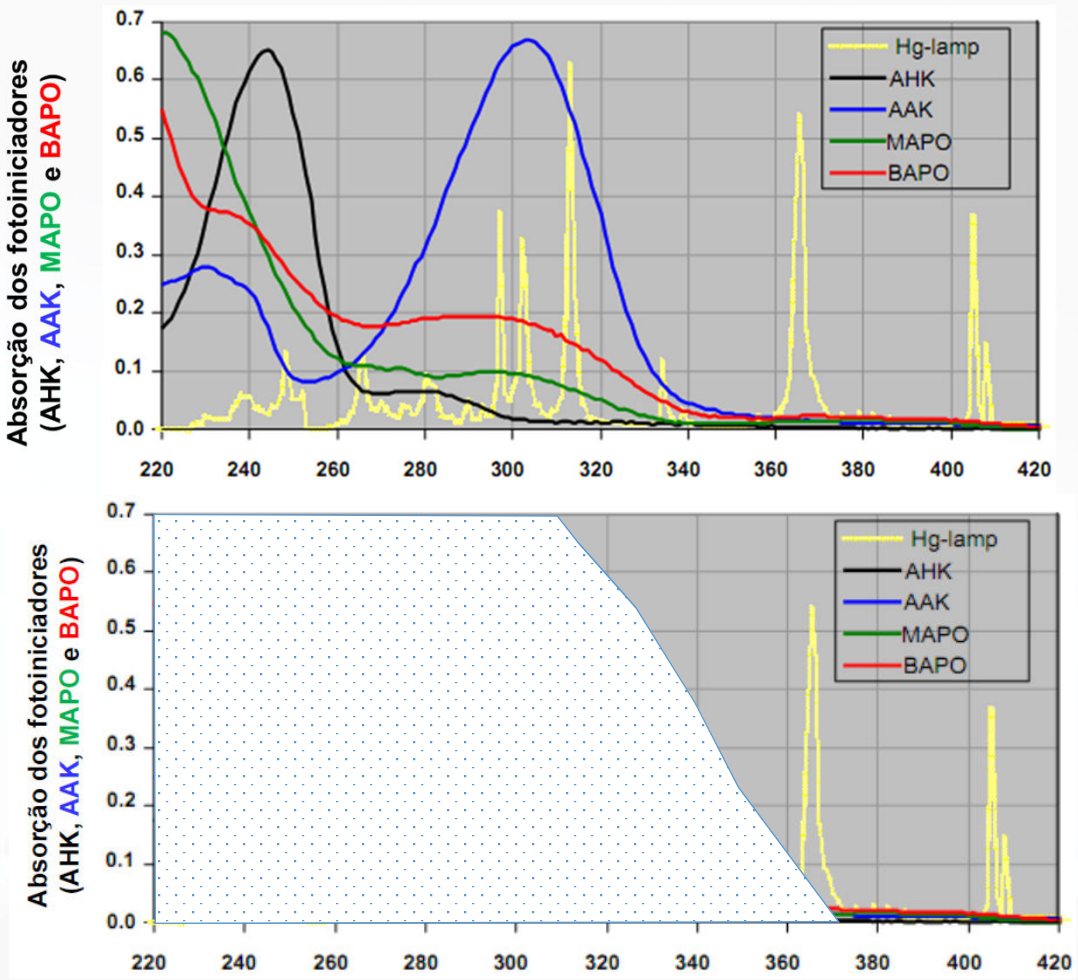
Photoinitiators – The clivage reaction





Inks Composition and Process

Photoinitiators



Printing Processes

Gravure

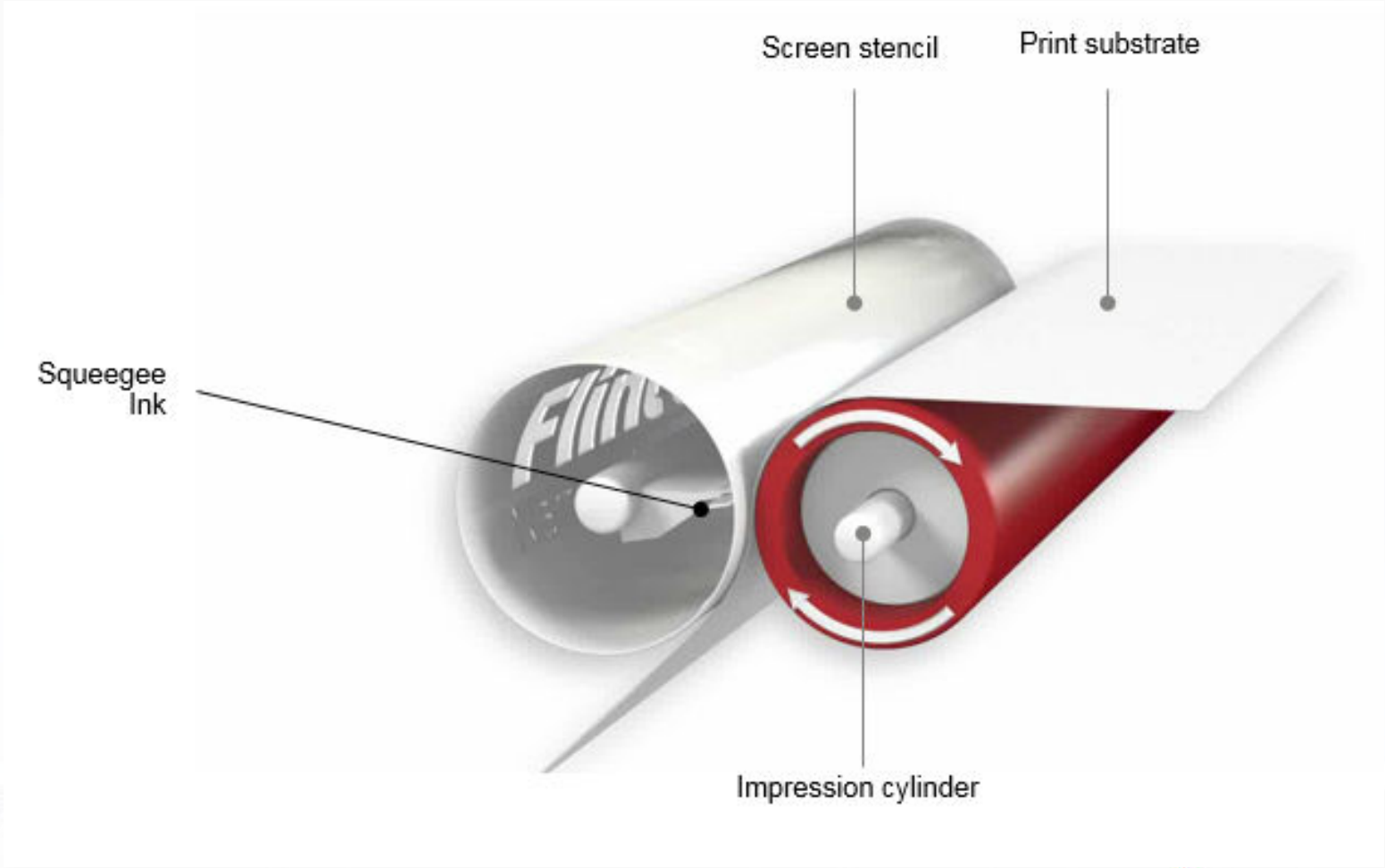
- The gravure process produces a print from an engraved cylinder.
- Gravure has traditionally been the higher quality of flexible packaging printing.
- It lays down more ink than flexo. Inks such as metallics, release lacquers and cold seal can be applied.
- Printing speeds are typically between 120 m/min to up to 300 m/min
- There are usually 10 printing stations all in a row.
- Each printing station is able to print one colour perfectly on it’s own.

Printing Processes

Flexographic unit

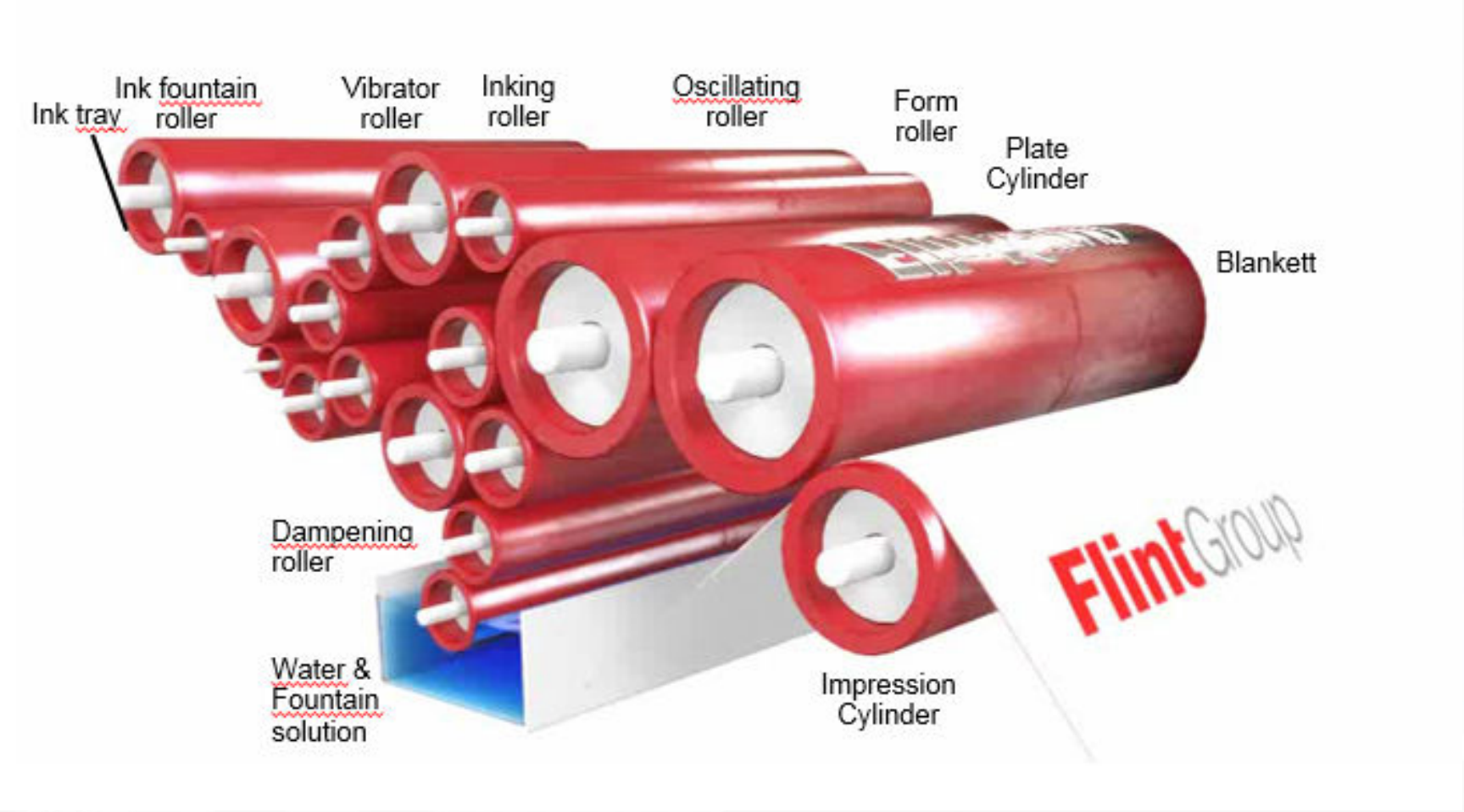
Printing Processes

Rotary Screen Printing



Printing Processes

Offset Unit



Printing Processes

UV Letterpress

Press Types

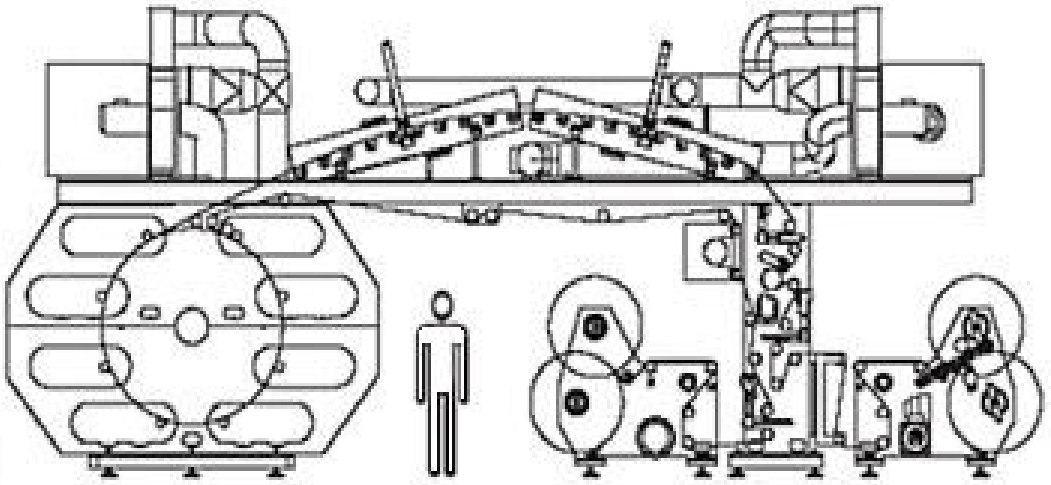
Wide web press / Packaging

A typical flexo press these days has between 8 & 10 print units

Most printers have at least one of these presses

Larger accounts have many (for 6) in one press hall.

Usually Flexo printing heads

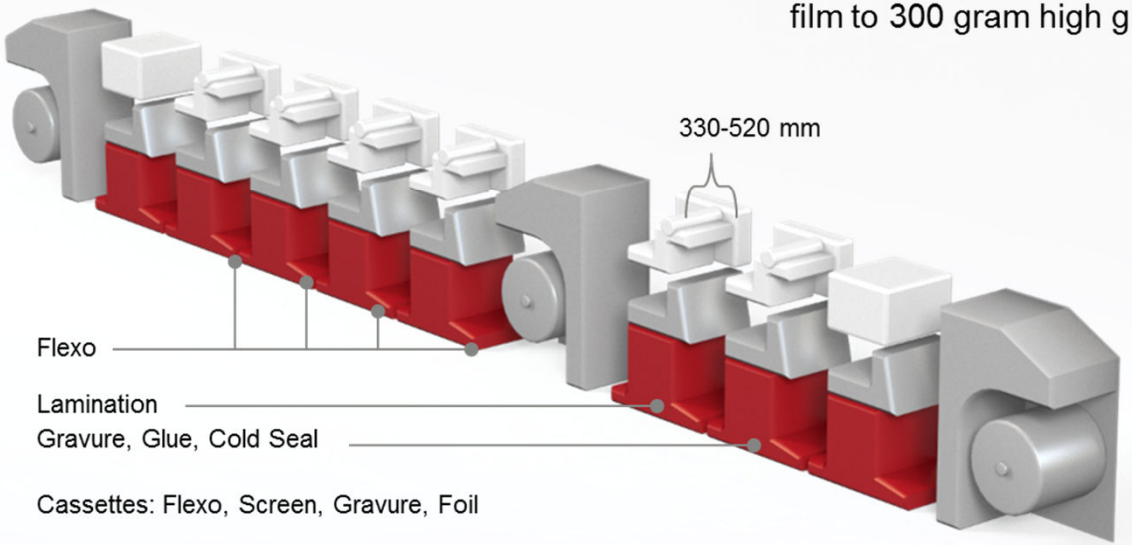


Press Types

Narrow Web Press

Never "a typical" Printing Press

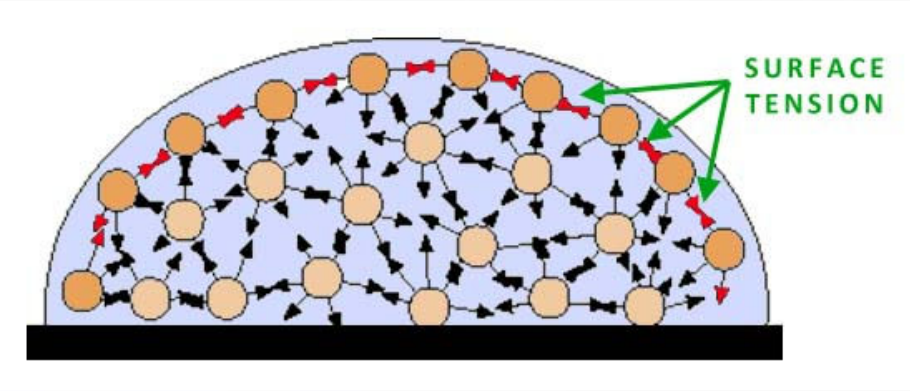
A NW press can handle substrates from 30 micron film to 300 gram high gloss carton

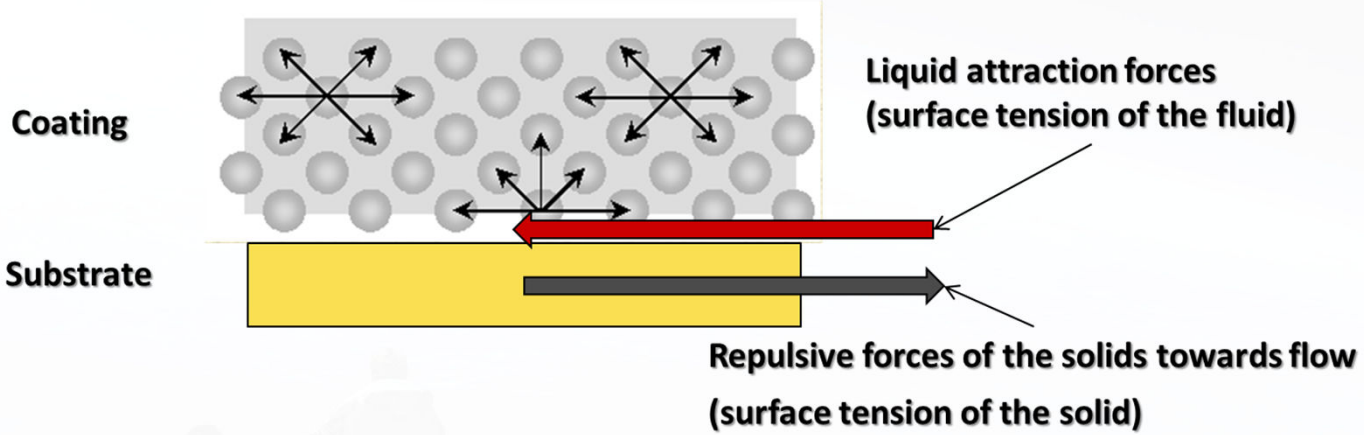


A Narrow web press can contain up to 6 different print methods, and in line finishing like hot foil, embossing, lamination. Converters use the optimal print method for individual jobs. Combining all kinds of print methods, in the same press by using printing cassettes. They may change print method 2-3 times during the day

Interaction with the substrate

Surface Tension



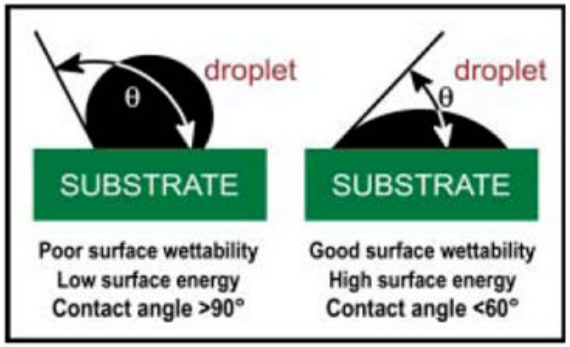


Ideal - Substrate wetting: Substrate Surface Tension > Coating Surface Tension

Good film establishment: Adhesion, Leveling, Flow, Gloss, D.O.I. (Image Definition).

Interaction with the substrate

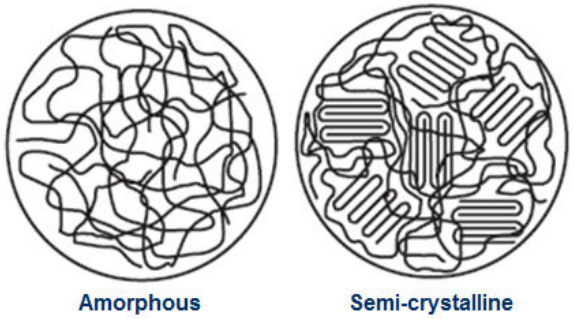
Surface Tension



Surface Energies of Untreated Polymers

Hydrocarbons	Surface energy (dynes/cm)
Polypropylene, OPP, BOPP	29-31
Polyethylene	30-31
Polyvinyl Acetate (PVA) Copolymer	33-44
Polystyrene	38
Polystyrene (low ionomer)	33
ABS	35-42
Polyamide	<36
Epoxy	<36
Polyester	41-44
Rigid PVC	39
Plasticized PVC	33-38
Engineering Thermoplastics	
PET	41-44
Polycarbonate	46
Polyimide	40
Polyacetal	<36
Polyphenylene oxide (PPO)	47
PBT	32
Polysulfone	41
Polyethersulfone	50
Polyphenylene sulfide (PPS)	38
Nylon	33-46

Amorphous vs. Crystalline



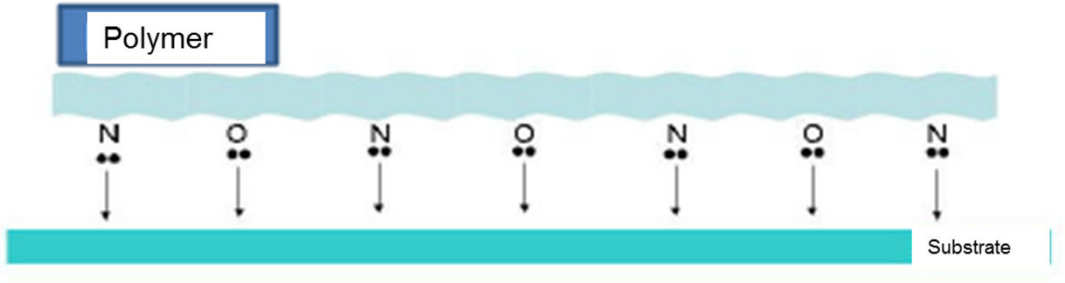
Vs.

Name	Abbr.	F	Surface tension/mN/m (25 °C)
isobornyl acrylate	IBOA	1	32
isodecyl acrylate	IDA	1	29
octyl/decyl acrylate	ODA	1	30
hexanediol diacrylate	HDDA	2	36
dipropylene glycol diacrylate	DPGDA	2	35
tripropylene glycol diacrylate	TPGDA	2	34
trimethylolpropane triacrylate	TMPTA	3	38

Interaction with the substrate

Adhesion

- **Mechanisms:**
  - **Solvent attack – chemical etching/chemical adhesion (acid methacrylates);**
  - **Polymeric affinity;**
  - **Polarity and anchoring points (Radiation Curing and WB*), H-Bonds**
  - **“Plasticity”**
  - **Surface roughness**



In WB or UV finishes, there is no substrate “attack” (except with acidic monomers as HDODA). In this case the chemical interaction is more dependent on the polymer type, polarity, plasticity (Tg) and flow characteristics as surface tension/substrate wetting, levelling and rheology.

Summary

- Inks compositions are similar, but the curing mechanisms are different and will be dependent on type of press, application, job and price.
  - Waterborne inks has the film coalescence as critical step.
  - Different from conventional systems, UV curable systems have a polymer formed during the application from a reactive liquid.
- There are different printing processes to address the different needs in the market and each one will demand a different ink technology.
- Regardless, a good printing is a consequence of a good laydown ink, ruled by how it interacts with the substrate, mainly in regards to surface tension and adhesion.