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# UV LED technology

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# AGENDA

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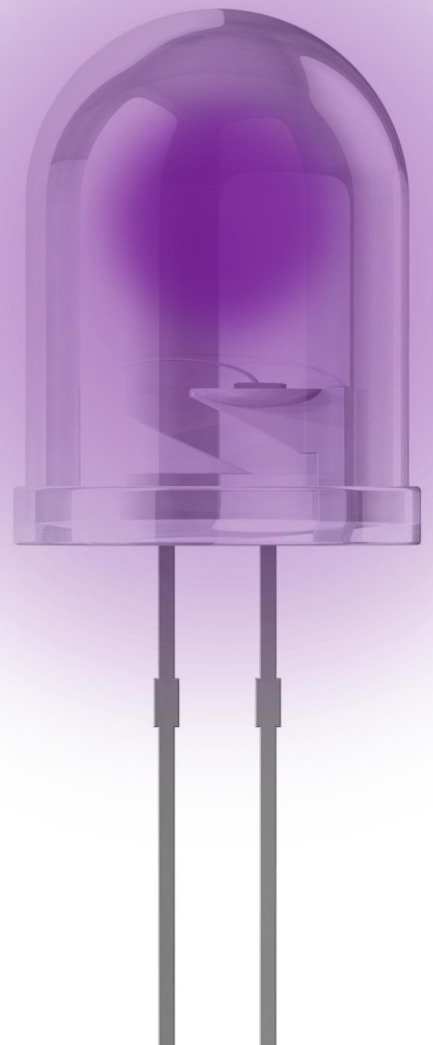
# Benefits of working with UV LED

# What is UV LED?

- **UV LED means UltraViolet Light Emitting Diode**

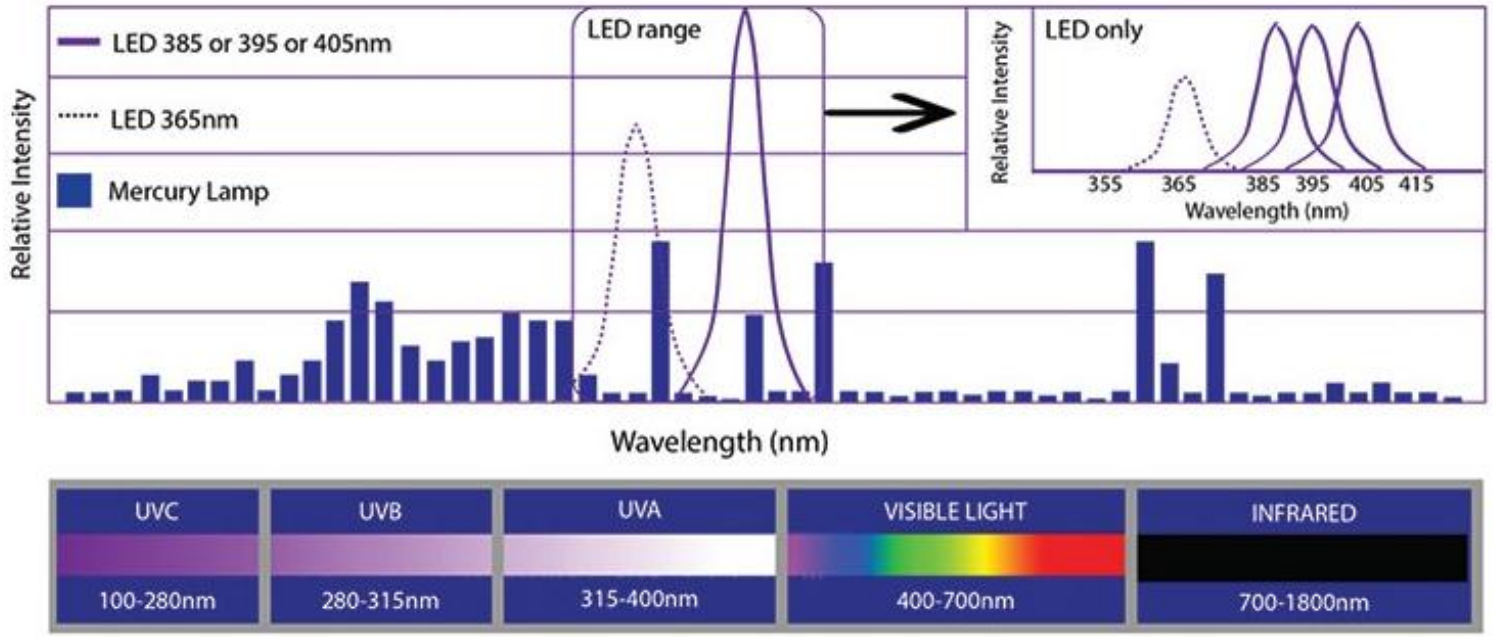
- UV LED is an alternative UV curing system to the traditional mercury-based lamps
- UV LED offers advantages over traditional mercury UV curing systems
- UV LED is not a ‘drop in’ replacement for mercury bulbs, but presses can be retrofit to UV LED or new presses with UV LED cure can be purchased
- UV LED curing systems require new inks formulated specifically for this process
- Most conventional UV inks will NOT cure with UV LED lamps adequately



# Differences in the lighting systems

UV Hg lamps give away several different wavelengths, mainly between 200-400 nm (UV range)

UV LED lamps are operating at 365, 385, 395 & 405 nm commercially today. Main one in use is 395 nm.



# Mercury Arc vs LED Curing – Comparisons

| | Mercury Arc | LED Curing |
|---|---|---|
| Lifetime | 500 – 2,000 hours | > 20,000 hours |
| Environmental | Mercury waste / Ozone generating | Mercury-free / Ozone-free |
| Input Power | Large | Small (~half) |
| Maintenance | Bulb replacement & cleaning | Maintenance-free |
| On/Off | Minutes | Instant |
| Heat | ~ 350°C | 60°C |

# Converter benefits

**More printers are moving away from traditional mercury curing to UV LED curing** – as regulations tighten on the use of mercury, UV lamps will become harder to acquire and dispose of, further speeding up the adoption of LED

| | | |
|---|---|---|
| **Significant Energy Efficiency** | **Benefit:** | Up to 80% higher energy efficiency compared to UV mercury counterparts. |
| | **Customer Value:** | Substantial energy savings translating into reduced operational expenses, particularly as energy costs continue to rise. |
| **Enhanced Curing Speed and Consistency** | **Benefit:** | Achieving faster, consistently high-quality curing. |
| | **Customer Value:** | Improved production efficiency and output quality, leading to streamlined operations and better end products. |
| **Reliability Through Lamp Longevity** | **Benefit:** | Consistent curing and reliability ensured by lamps that don't degrade over time. |
| | **Customer Value:** | More security of cure for Food packaging applications, lower consumables cost, extended operational uptime, and minimised disruptions due to reduced need for lamp replacements. |
| **Elevated Productivity and Ease of Maintenance** | **Benefit:** | Boosted productivity with lamp durability, lower running temperatures, and simplified maintenance. |
| | **Customer Value:** | Longer service life, fewer maintenance requirements, and uninterrupted production, resulting in increased output and reduced downtime. |

# Converter benefits

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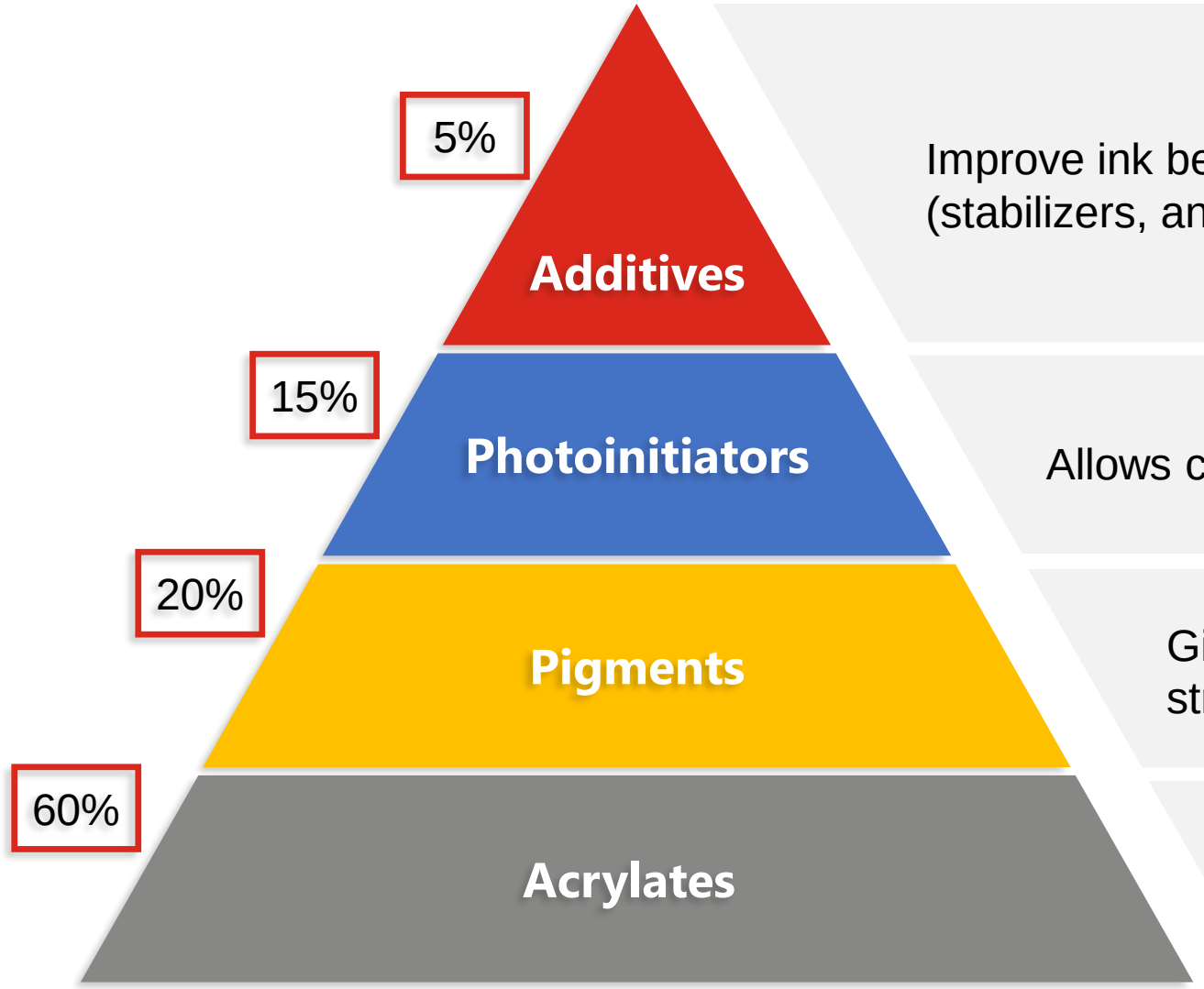
| | | |
|---|---|---|
| **Instant On/Off with Reduced Waste** | **Benefit:** | LED lamps instantly reaching full capacity upon activation. |
| | **Customer Value:** | Reduced waste, more uptime, improved flexibility, and less resource consumption due to instant on/off capabilities, contributing to a more sustainable operation. |
| **Simplified Maintenance and Operation** | **Benefit:** | Fewer lamp faults, minimal need for replacements, and reduced ancillary tasks (shutters, reflectors, venting, etc.) |
| | **Customer Value:** | Less downtime, decreased replacement costs, and streamlined maintenance efforts, allowing resources to be directed more efficiently. |
| **Health, Safety, and Environmental Advantages** | **Benefit:** | Avoiding issues associated with ozone, blowers, and venting. |
| | **Customer Value:** | Enhanced occupational health and safety (HSE) compliance, reduced environmental impact, and a safer and more pleasant working environment. |
| **Monetary and Environmental Savings** | **Benefit:** | Savings not only in currency but also in CO2 emissions. |
| | **Customer Value:** | Tangible cost reductions, coupled with a positive ecological contribution, showcasing a commitment to sustainability. |

# What is an UV ink? What do we use to make an UV ink? How do we make an UV ink?

# UV Inks Pyramid – Components of UV inks

Share in %



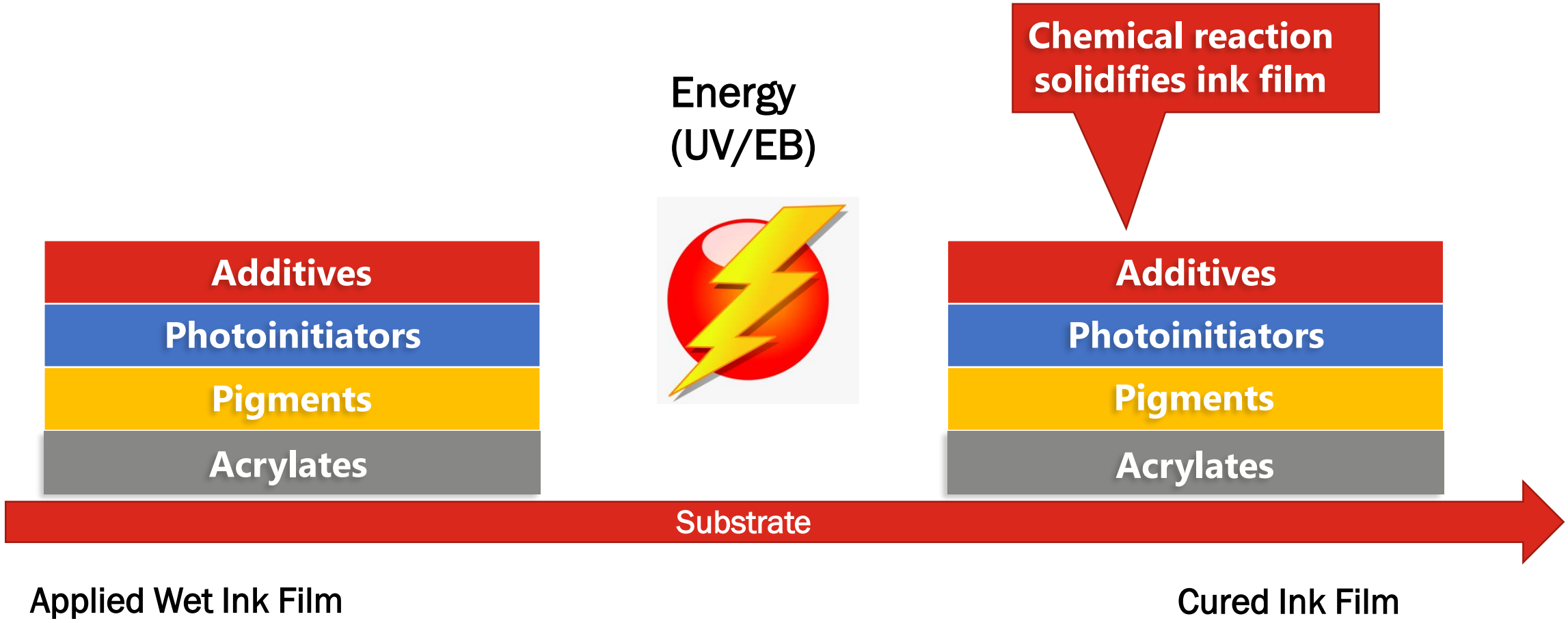

Improve ink behavior on press (stabilizers, antifoam, wetting or slip agents)

Allows cure of the ink under UV light

Give the ink its color shade and strengths

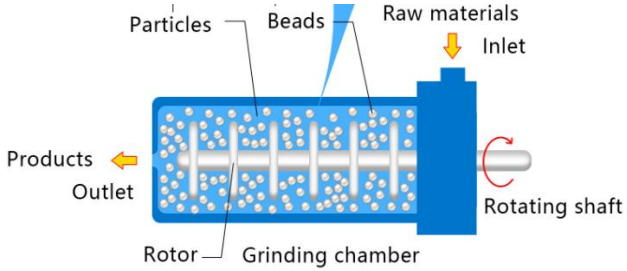
Define the ink mechanical and chemical properties (viscosity, resistance, etc.)

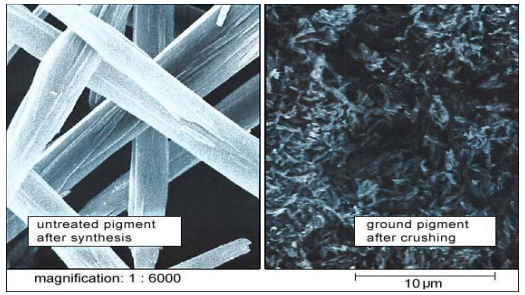
# How energy curable chemistry works on press



# How is an UV ink produced?

- **Premixing** is the addition of pigments, wetting acrylates & wetting additives
- **Grinding** is when the pigment particles are processed to their correct sizes
  - Several types of machinery can do this
- **Let-down** stage is when the grinding process is complete and any other components need to be added
- **Final mixing** as a last step to make a homogenous ink




Premix

Grinding

Let-down

Final mixing

# Overview Dual Cure inks from Flint Group

# The EkoCure® range at a glance

Product range / Performance attributes

| | EkoCure® F | EkoCure® ANCORA F2 | EkoCure® ANCORA |
|---|---|---|---|
| FCM / Food contact | NO | YES | |
| DualCure / LED &Mercury | YES | YES | YES |
| Low Viscosity | ●●● | ●●● | ●● |
| Curing Speed | ●●● | ●● | ●●● |
| Colour Strength | ●●● | ●●● | ●●● |
| Full range | ●●● | ●●● | ●● |
| Press performance | ●●● | ●●● | ●●● |
| Adhesion | ●●● | ●●● | ●●● |

●●● **Excellent** ●● **Good** ● **Limited use**

# User Guide

# User Guide

## Storage

- Optimal storage conditions is around 20-25 °C (68-77 °F) in a dark room.
- Ink should not be allowed to freeze.
- Let the ink acclimate to room temperature some hours before printing.
- Avoid exposure to direct sunlight, overhead press room lighting and heat. UV LED inks are sensitive to visible light and heat which can cause premature polymerization.

## LED lamp

- Recommended UV LED lamp is minimum 16 Watt/cm2 with a wavelength of 395nm or 385nm.
- Distance between lamp to material influence the irradiance and the curing of the inks. Check with lamp supplier for correct distance
- Temperature of chilling rollers / chill plate adjacent to lamps should be 25-35 °C.
- Too low temperature will inhabit curing properties
- Too high temperature might affect heat sensitive materials.
- The power output (percentage) of each LED lamp can be adjusted to print speed. Note that enough LED power is set to the print speed. I

## Ink pumping

- At pumping (automatic ink dispensers or pumps to ink pan/chamber at press) make sure pumps are dimensioned for a viscosity up to minimum 2 Pas.
- Pumping distance and height should also be considered when selecting the pumps.
- Avoid mixing air into system and avoid re-circulation of ink. This to avoid foaming and air is trapped in the ink. •
- Challenging shades which are more thixotropic are red and orange shades (Warm Red, Rubine Red, Red 032, Magenta and Orange).
- GSE Dispensing have worked out a solution with focus: - External tanks with heater and stirrer - Stronger pumps with more power and pressure - Hoses with larger diameter

# User Guide

## Handling instructions

- Shake/agitate ink before use.
- Inks should not be mixed with any other UV, WB or conventional ink.
- Only use advised additives as can be found in TDS.
- Ensure that GMP (Good Manufacturing Practice) are respected for food application. For Housekeeping guide-lines for food packaging, please refer to separate Food Packaging folder.
- If possible, preheat the ink to optimal temperature (30-35 °C), to counter the higher viscosity / thixotropy (and to get improved ink performance and stable transfer). Some presses are equipped with feasibility to pre-heat the ink by anilox running in press, without printing.
- Protect UV LED inks from all light exposures. Put the lid on immediately after use, close the spout after pouring, shield ink in ink pan and hoses from lights. LED inks that are exposed with too much light may lead to problem with premature polymerization, viscosity increase or stability problem.
- Recommended light source in press room is 2700-3000 Kelvin for UV LED systems. (for details see Technical Information “Light source selection”)
- UV inks and coatings are sensitive to metal oxides and should be processed through stainless steel or plastic materials. It may affect the viscosity and stability.
- When mixing pastel shades use TTR Varnish instead of Transparent White as mixing media to minimize the yellowing effect after cure
- Use recommended anilox rollers that are specified in TDS. For best ink transfer, use anilox with low line count.
- Use high quality doctor blades. For Pantone and solid printing a thickness of 0,20-0,30mm is preferable. This to prevent ink spitting. For process printing down to 0,15mm is recommended.
- Notice that the thickness of doctor blade might affect the transfer. Thinner blade increase ink transfer.

# User Guide

## At printing

- EkoCure® ANCORA F2™ is primarily developed for pressure sensitive labels (PSL) and should be printed up to max 100-150m/min depending on print design and UV LED lamp performance.
- Check surface cure by thumb twist or smearing to unprinted areas. Fatty/greasy surface may indicate poor surface curing.
- Check tracking/set-off on idler rollers (turning bars).
- Some shades, especially Transparent white, Opaque White and varnish may yellow directly after printing when exposed too high LED dose. But the photo-bleaching effect reduces the yellowing over time.
- To optimize ink transfer (higher density) following factors have great impact: o ink temperature (30-35°C) o selection of plate o use hard tape and o thin doctor blade
- Acceptable speed limits for food applications have to be validated by migration tests.
- When printing longer jobs at high print speed, frictions from doctor blades and end seals may increase the temperature in chamber system. Make sure ink do not reach temperature above 45-50°C since the stability and viscosity will be effected. Use plastic blade in the lower blade position and foam rubber based end seals to reduce frictions and temperature increase.

## After printing

- Ink left-overs after printing are not recommended to be poured back into fresh ink as this may affect shelf-life. Store left overs in separate buckets
- As long as EkoCure® ANCORA F2™ is not exposed to UV light, direct sunlight or excessive heat, it will not cure in the press. But since LED inks are more sensitive to visible lights it is recommended to clean sensitive parts (e.g. anilox) direct after printing and make sure ink pan and chamber is not exposed to any lights.

# Tips & Tricks

## Increase ink transfer without using higher anilox volume –

- Optimal ink temperature 30-35°C
- Use hard tape - Chose plate with good transfer
- Use thin doctor blade

## To reduce frictions and prevent too high temperatures (45-50°C) in chamber systems

- Use plastic blade in the lower blade position
- Use foam rubber based end-seals to reduce frictions and temperature increase

## To reduce yellowing

- Use TTR varnish instead of Transparent White at mixings when mixing pastel shades
- Avoid over curing the inks