



Coatema Flexography

Overview

Introduction

Motivation

Flexography
printing

Components

Summary

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Introduction

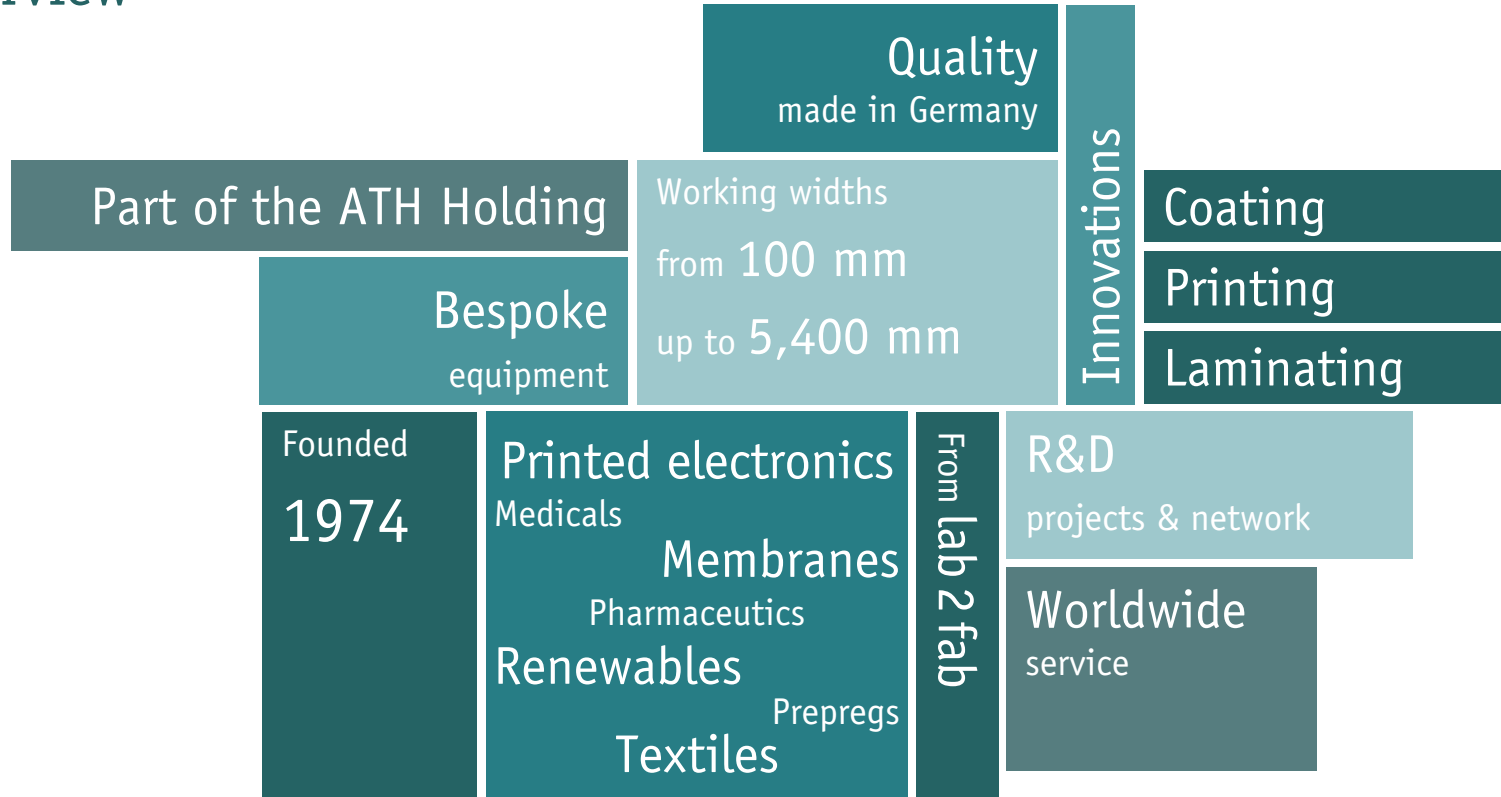
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Summary

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Group of companies

ATH ALTONAER
TECHNOLOGIE
HOLDING



- ✓ Founded 1903
- ✓ Approx. 200 employees
- ✓ Located in Hamburg



- ✓ Founded 1995
- ✓ Approx. 50 employees
- ✓ Located in Norderstedt



- ✓ Founded 1974
- ✓ Approx. 50 employees
- ✓ Located in Dormagen

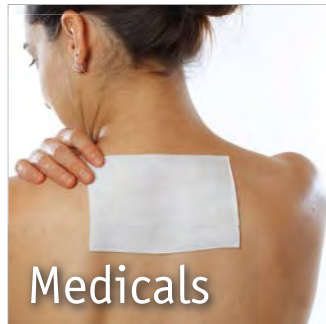
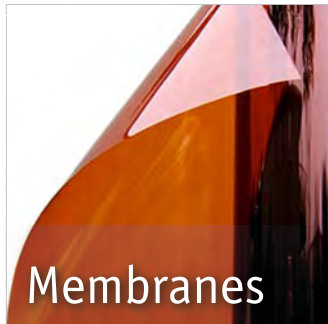
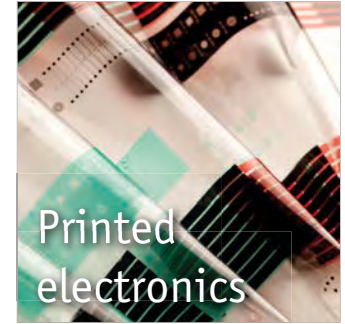
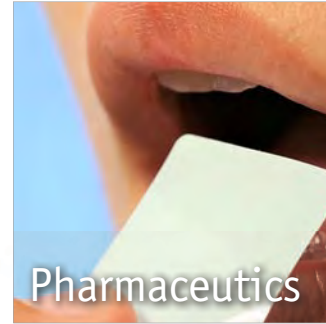
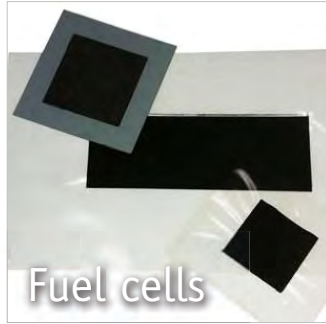
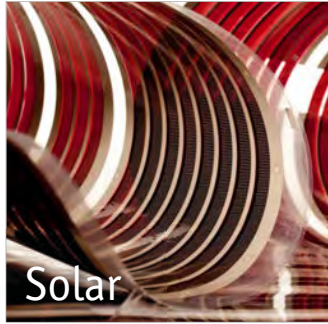


- ✓ Founded 1919
- ✓ Approx. 140 employees
- ✓ Located in Hamburg

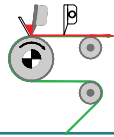
Represented worldwide



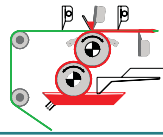
Our markets



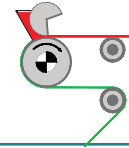
Coating systems



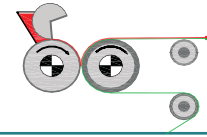
Knife system



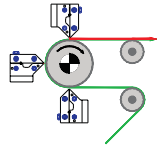
Double side system



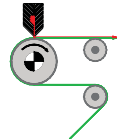
Commabar system



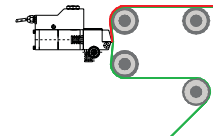
Reverse commabar system



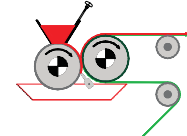
Slot die system



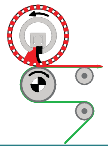
Curtain coating system



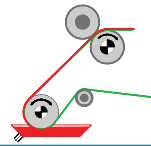
Hotmelt slot die system



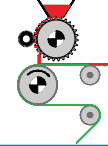
Case knife system



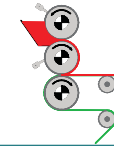
Rotary screen system



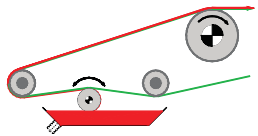
Dipping system (Fouard)



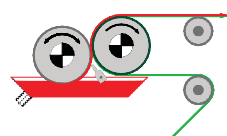
Powder scattering system



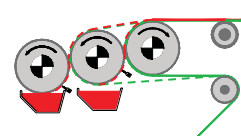
Reverse roll system



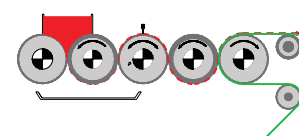
Micro roller system



2 Roller system

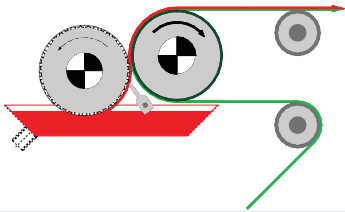


3 Roller combi system

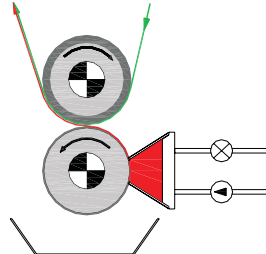


5 Roller system

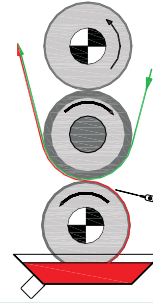
Printing systems



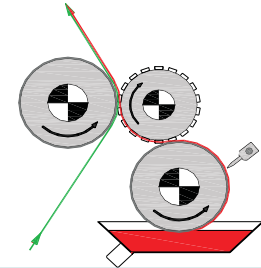
Engraved roller system



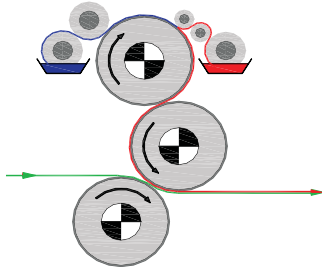
Gravure roller system



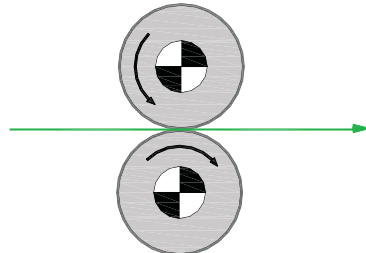
Gravure indirect system



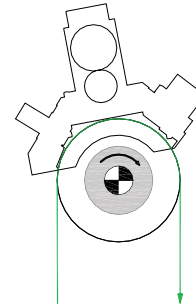
Flexography system



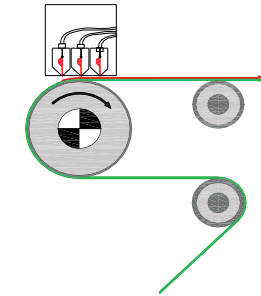
Offset lithography system



Hot embossing system



Nanoimprint system



Inkjet system

Our work in associations – global networking



Board Member:
OE-A

Advisory Board:
Fraunhofer ITA

Coatema customers



R&D customers



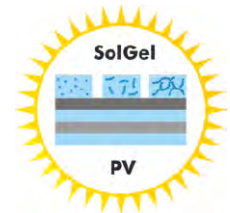
R&D projects overview 2020



Oled Solar



E-Nanoprint Pro



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printing

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Summary

Motivation

Definition & origin of flexography

- ✓ Flexography creates an image through relief printing, using flexible plates to form a raised negative of the image, which is inked and then transferred onto the substrate using pressure.
- ✓ Johannes Gutenberg developed the **letterpress** in 1440
 - ✓ A raised hard surface plate is inked and pressed against a sheet of paper
 - ✓ Movable and reusable lead metal types



History of flexography

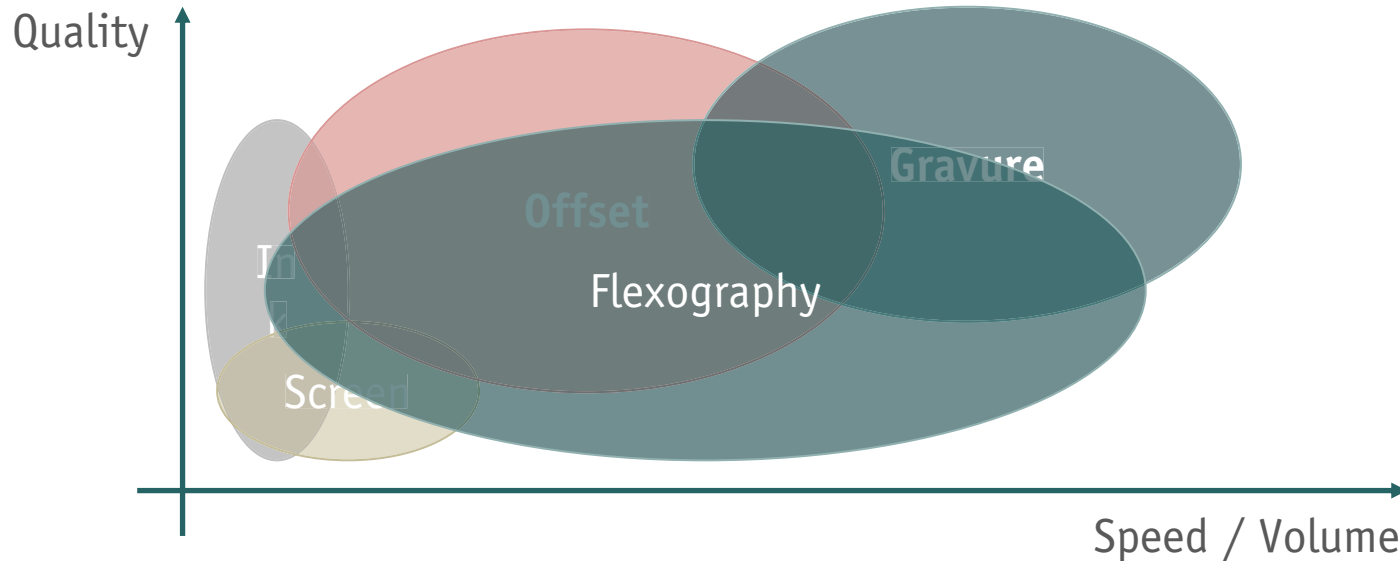
- ✓ Original name of this letterpress process is „aniline printing“
 - ✓ Use of aniline dyes diluted in alcohol in the mid 19th century

- ✓ 1950s: New name
 - ✓ Flexographic process

- ✓ Until 1970:
 - ✓ Exclusively rubber printing plates
 - ✓ Printing of wrapping papers

Printing parameters

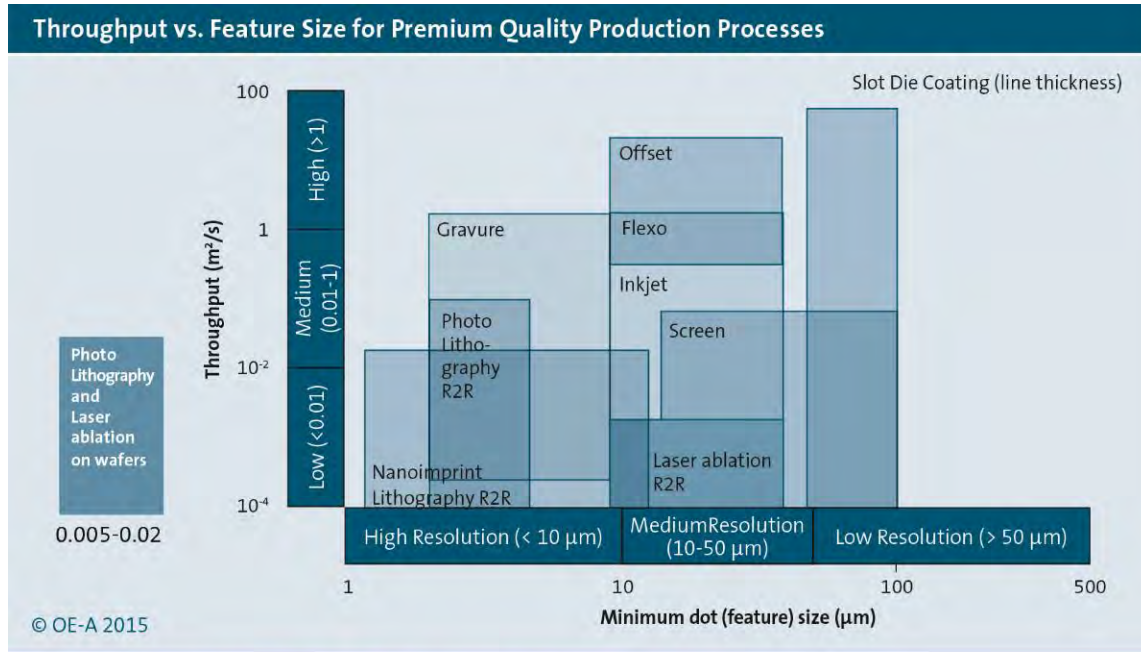
Compared to other techniques flexography offers a large window of quality and speed.



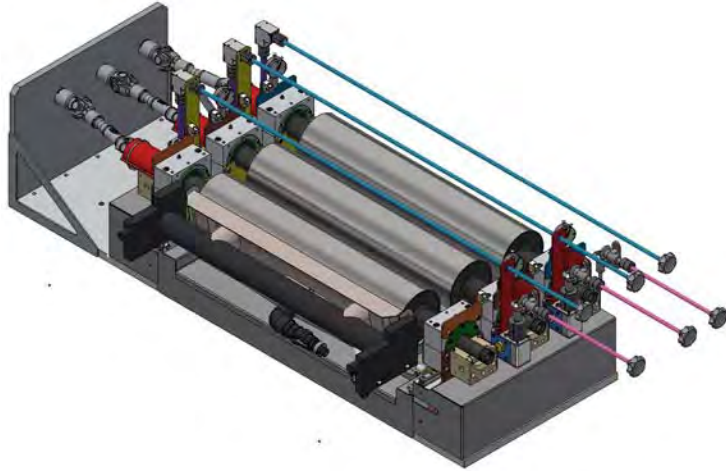
Printing parameters

| Printing method | Printing speed (m/s) | Nip pressure (MPa) | Ink viscosity (Pa · s) | Layer thickness (µm) | Feature size (µm) | Registration (µm) |
|-----------------|----------------------|--------------------|------------------------|----------------------|-------------------|-------------------|
| Flexography | 3 – 10 | 0.1 – 0.5 | 0.01 – 0.5 | 0.04 – 8 | 40 – 80 | 20 – 200 |
| Gravure | 10 – 16 | 1.5 – 5 | 0.01 – 0.2 | 0.1 – 12 | 20 – 75 | >10 |
| Offset | 8 – 15 | 0.8 – 2 | 1 – 100 | 0.5 – 3 | 25 – 50 | >10 |
| Screen printing | 2 | - | 0.1 – 50 | 3 – 100 | 75 – 100 | >25 |
| Inkjet | 1 – 5 | - | 0.001 – 0.03 | 0.01 – 0.5, 20 (UV) | 10 – 50 | <10 |

Printing parameters



Printing systems



Introduction

Motivation

Flexography
printing

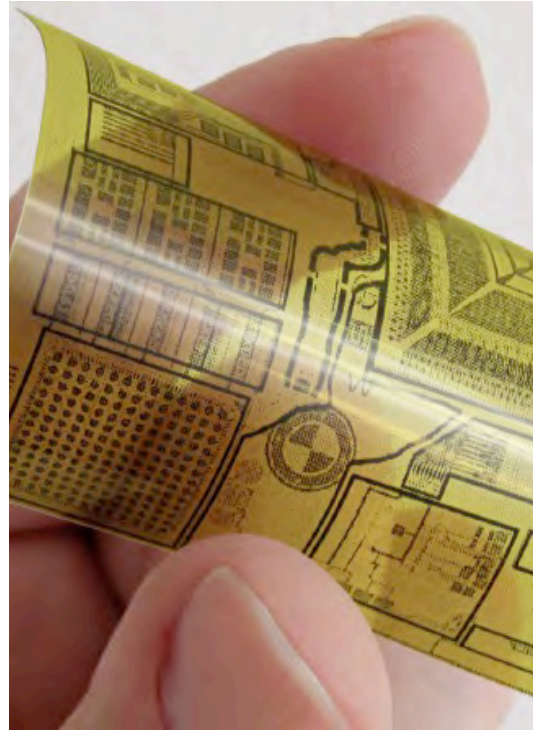
Components

Summary

Flexography
printing

Ongoing improvements

- ✓ Evolution of letterpress
- ✓ Image on a soft plate
- ✓ Graphic applications
 - ✓ Packaging
 - ✓ Publications like magazines
- ✓ Improved quality over last 25 years
 - ✓ Press
 - ✓ Plate
 - ✓ Anilox

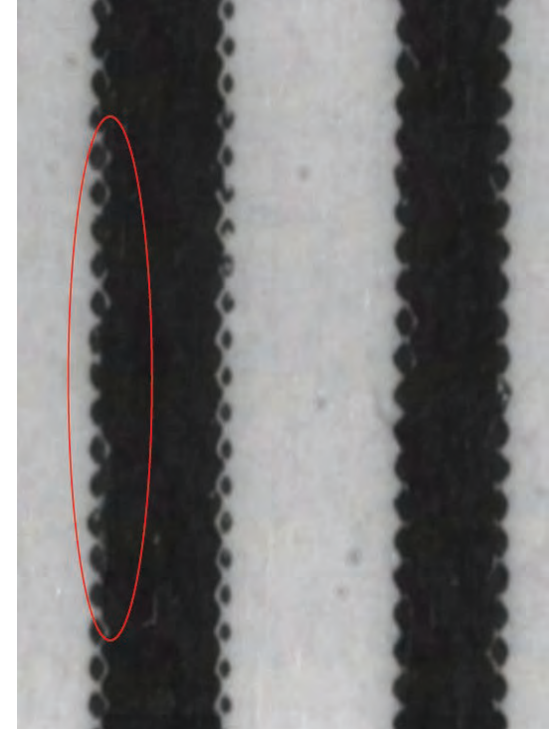


Printing technologies

- ✓ Inkjet, screen printing and conventional rotogravure
 - ✓ Lines are generated by combination of printed dots
 - ✓ Limits in line resolution

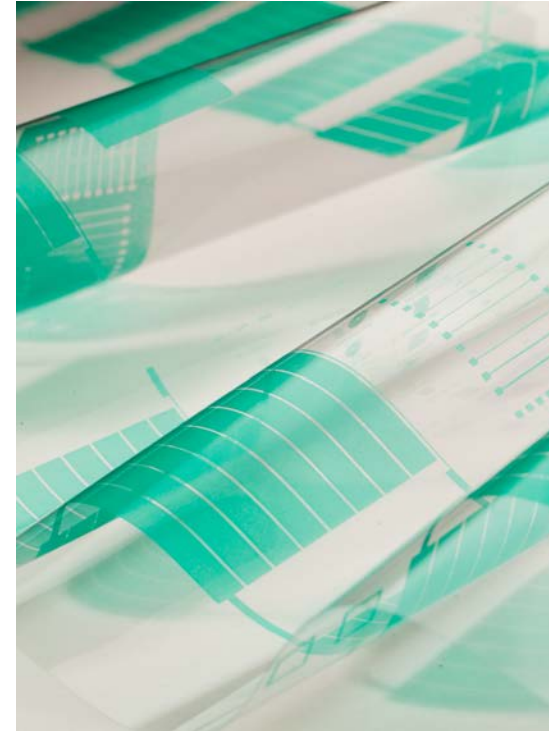
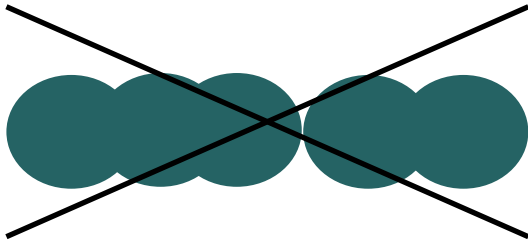


→ Flexography as solution

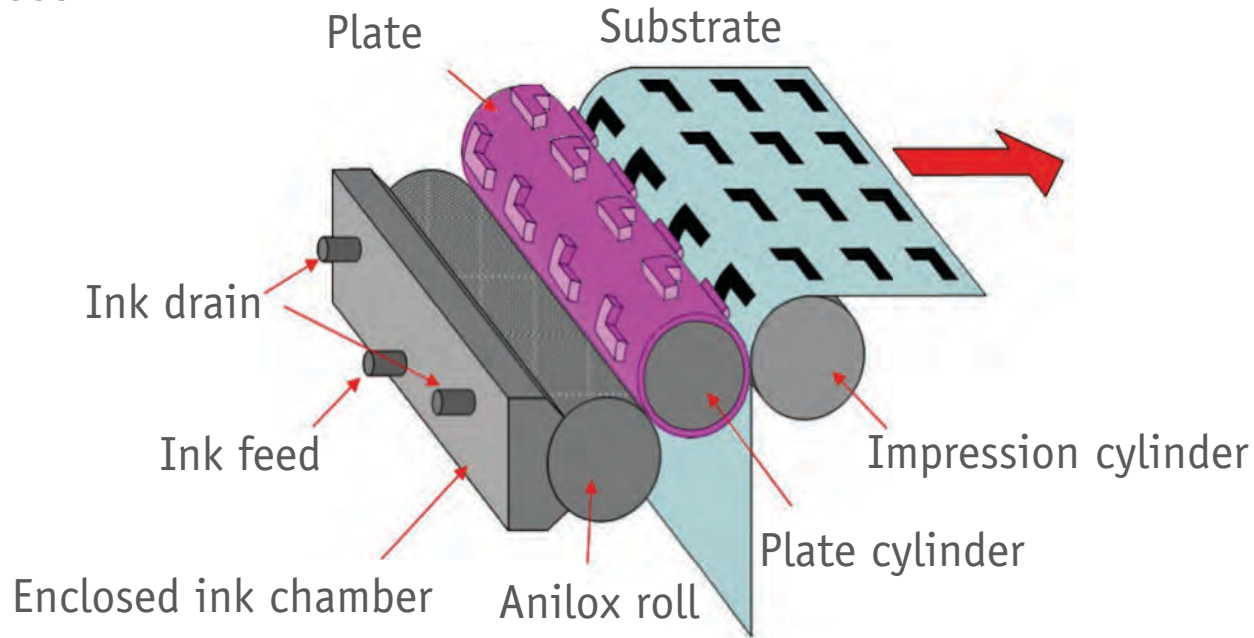


Printing continuous lines

- ✓ Relief plate allows the deposition of ink as continuous lines instead of a series of joining dots (e.g. inkjet)



The process



Raised image on polymer plate pick up the ink from an engraved cylinder (anilox) and deposit it over the substrate.

Flexographic press

- ✓ Industrial press offers mechanical stability and controls for accurate printing
 - ✓ Stack presses, in-line systems, central impressions machines
- ✓ Medium-high initial capital cost: a limit to research



Soucre: Kroenert

Advantages and limitations

Advantages

- ✓ High resolution
- ✓ Excellent accuracy
- ✓ Good deposition rate with a smooth texture
- ✓ No limit to the substrate
 - ✓ Paper, board or unsupported films
- ✓ Fast & cheap process for long-term applications
- ✓ Ideal R2R patterning for functional materials

Limitations

- ✓ Limited thickness of layers (wet 5 – 30 μm)
- ✓ Not ideal for short print runs
 - ✓ High initial cost for printing plates
 - ✓ Plate changing → time consuming
- ✓ New techniques offer bolder colours, more highly defined images and complicated designs

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Motivation

Flexography
printing

Components

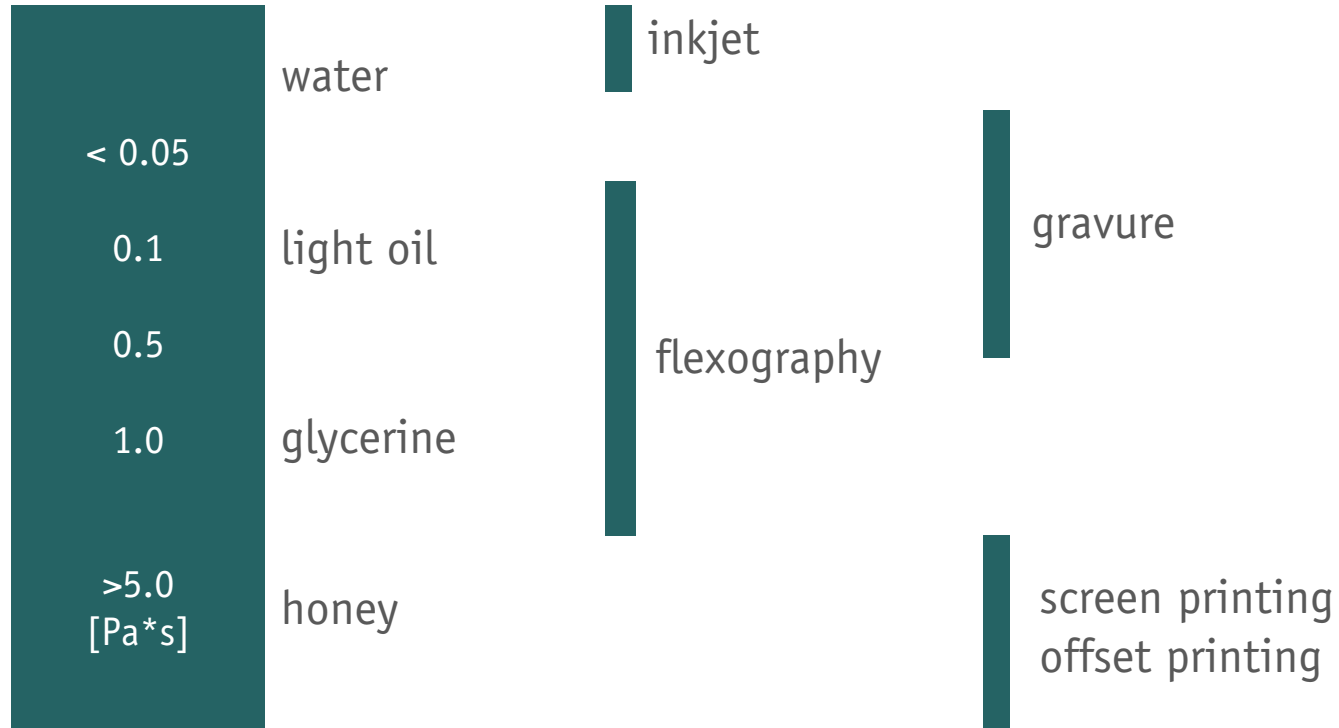
Summary

Components

Flexographic inks

- ✓ Flexible formulation similar in composition to inks used in gravure package printing
 - ✓ Colorants (dyes or pigments)
 - ✓ Binding agents (resins or plastics)
 - ✓ Solvent or solvent blend
- ✓ Wide viscosity range (0.05 – 3 Pas)
- ✓ Processing big particles up to 10 – 20 µm
- ✓ High deposition rate
 - ✓ R2R speed up to 500 – 800 m/min

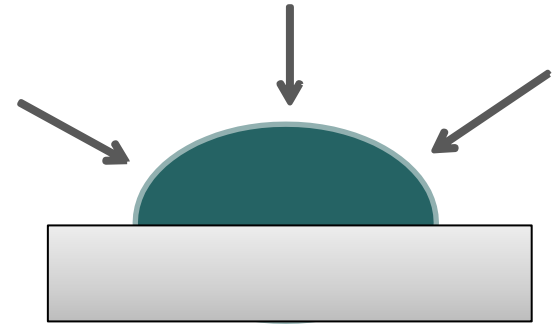
Viscosity of inks for flexographic printing



Ink behaviour

- ✓ Surface tension (hypothesis)
 - ✓ Lines <200 µm range
 - ✓ Surface tension is the dominant force
 - ✓ Due to quality of starting deposit line structure is kept avoiding inconsistencies

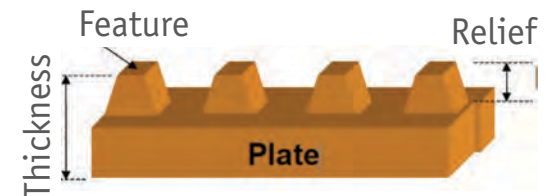
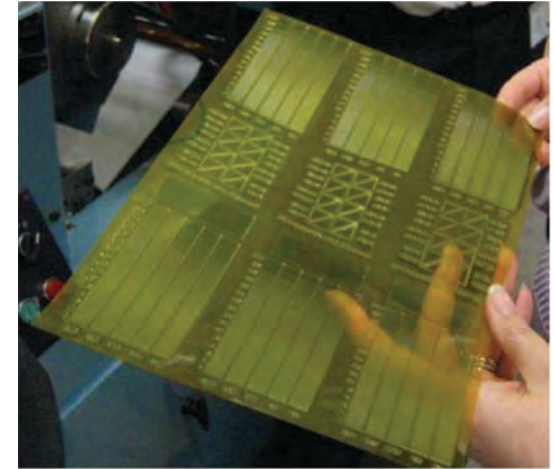
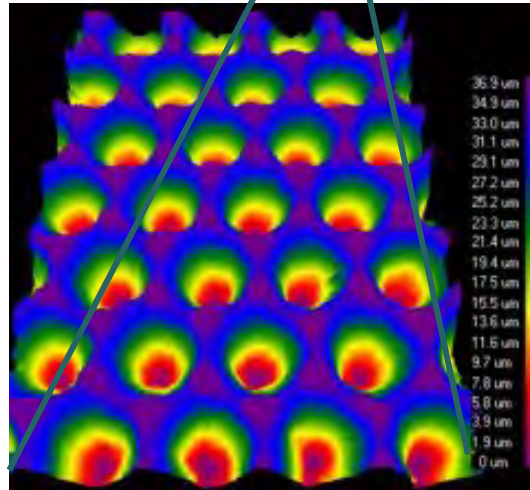
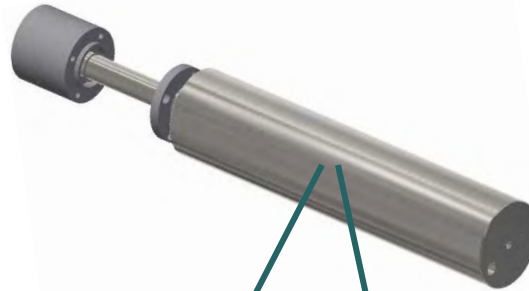
- ✓ Too high pressure
 - squeezing the ink out
 - ✓ Printing defects
 - ✓ Blank or semi-blank spaces in middle



Soucre: blog.luminite.com/blog/flexo-printing-defects-doughnuts

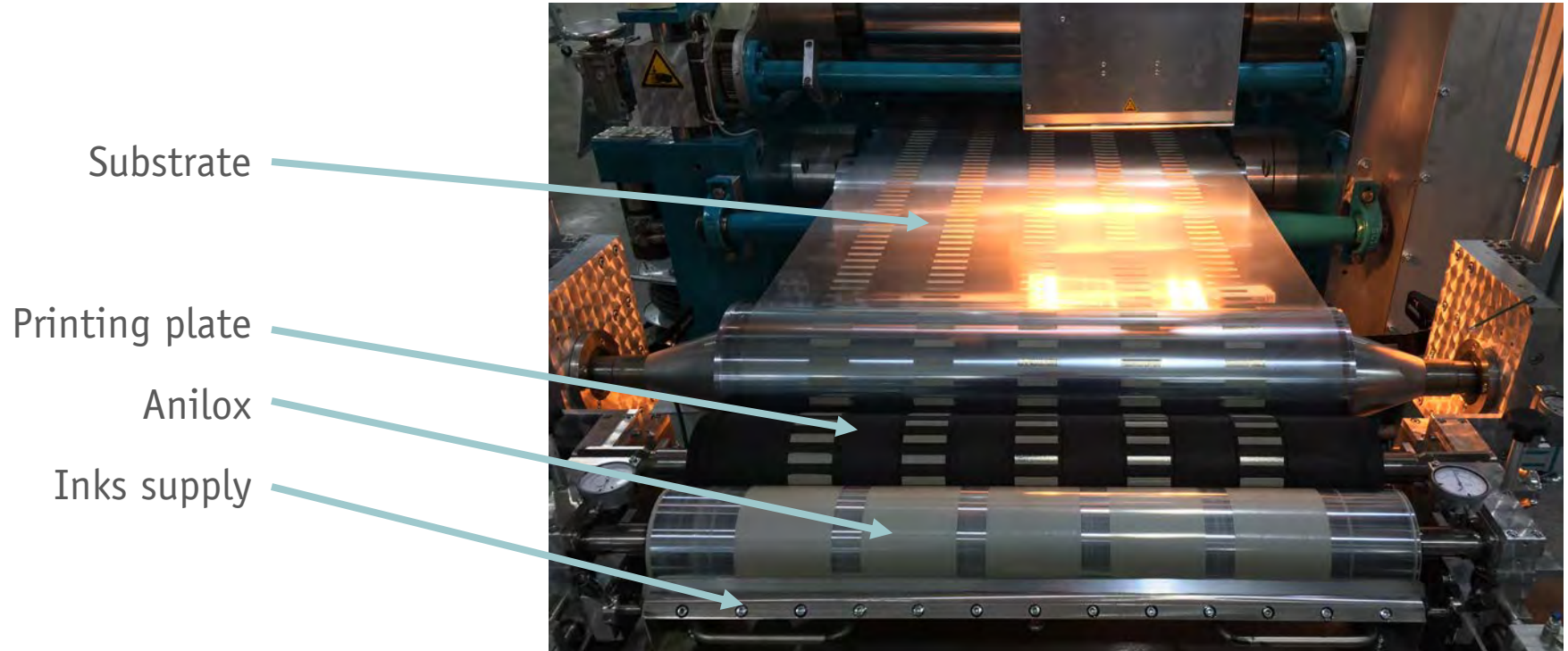
The components

- ✓ The anilox
- ✓ Metering system
- ✓ Ceramic cylinder
- ✓ 100 & engraved
- ✓ The plate
- ✓ Image carrier
- ✓ Soft photopolymer
- ✓ UV exposure created a raised surface for printing from it
- ✓ Taped around cylinder
- ✓ Improvements in plate resolution

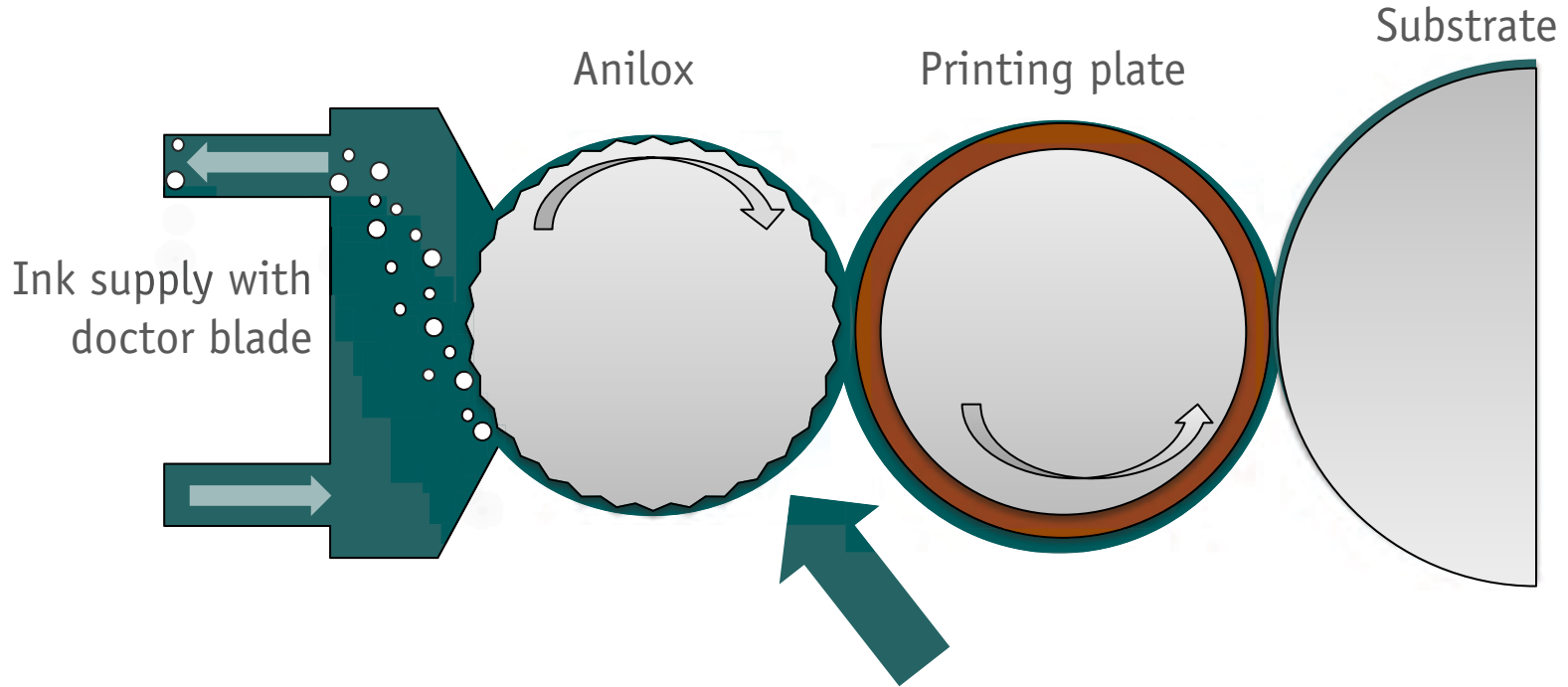


Soucre: www.zecher.com/rasterwalzen/keramikrasterwalzen

The components

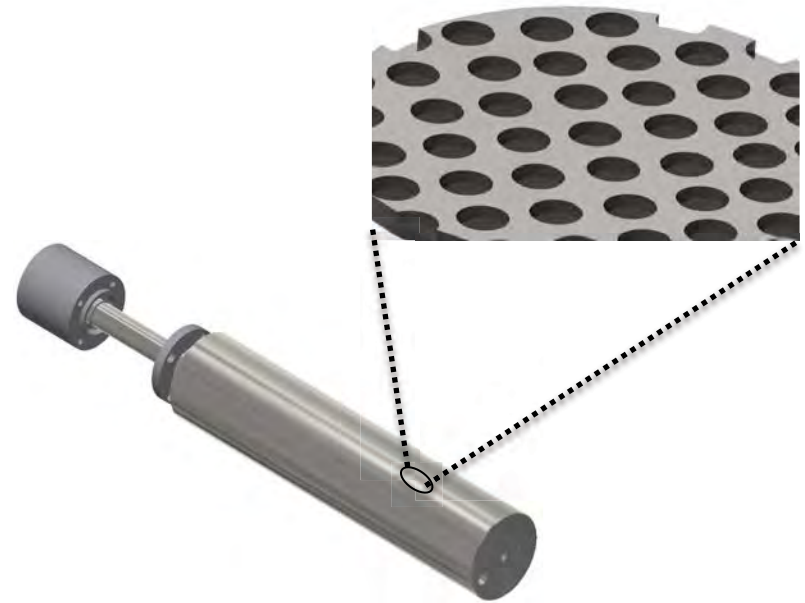


Anilox

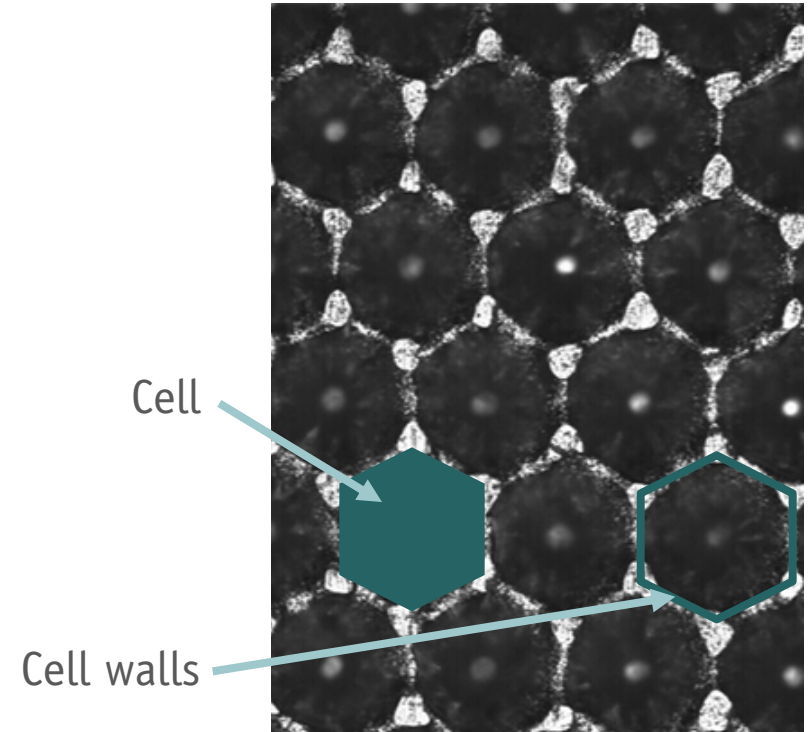
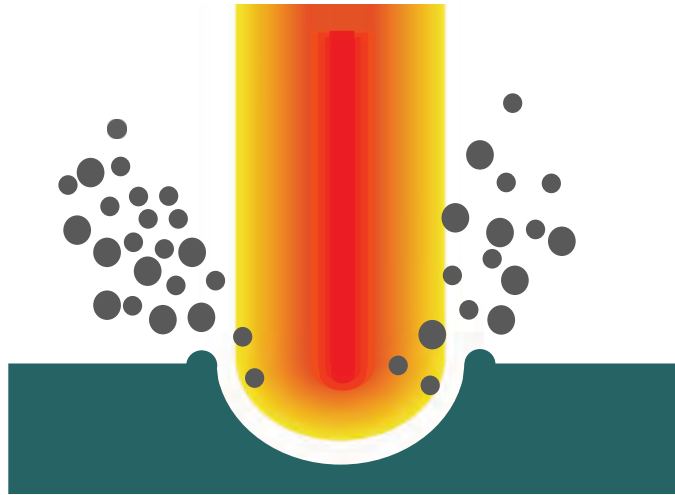


Anilox

- ✓ The heart of the flexo printing system
- ✓ Most critical component to be optimized
- ✓ The most sophisticated component in the printing group
- ✓ The only component determining the quantity of ink transferred onto the printing plate
- ✓ Usual laser engraved ceramic cylinder



Manufacturing the anilox



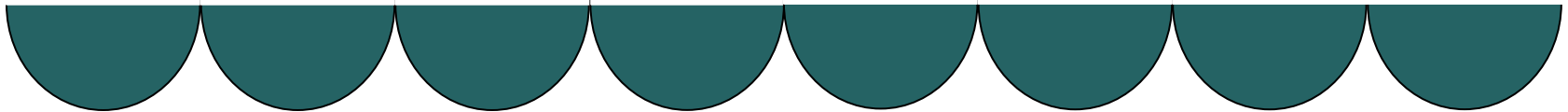
Source: www.zecher.com/rasterwalzen/keramikrasterwalzen/

Line count

- ✓ Number of cells per linear measure
- ✓ Lines per centimetre [l/cm, lpi]



250 lines



150 lines

Anilox dipping – 5 to 1 ratio

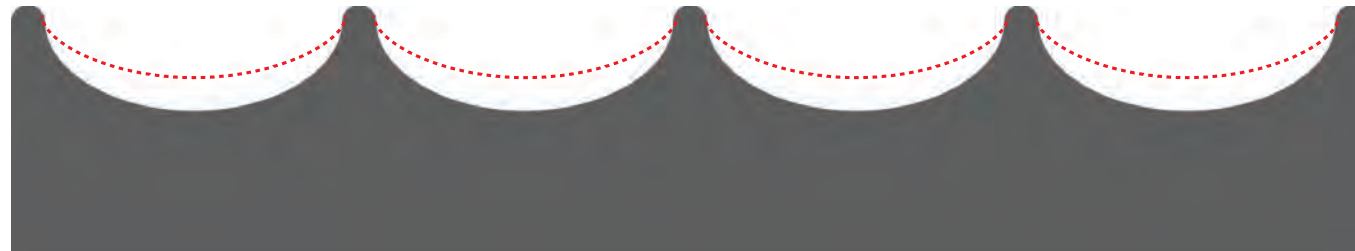
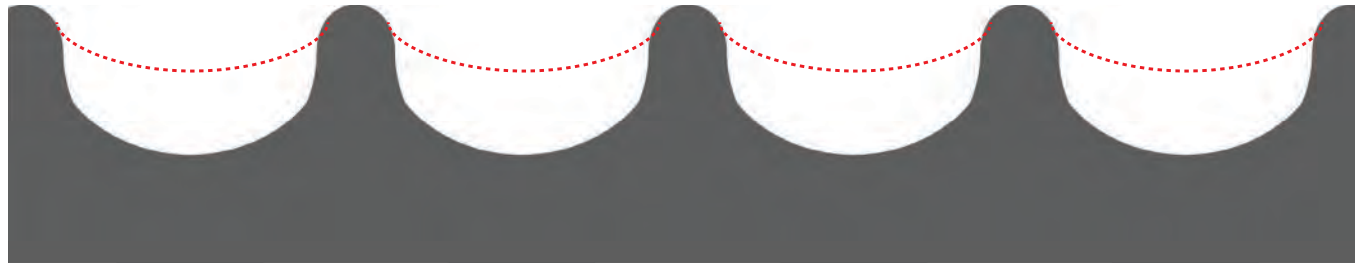
- ✓ Correct anilox and image resolution



- ✓ Coarse anilox and image resolution → dipping

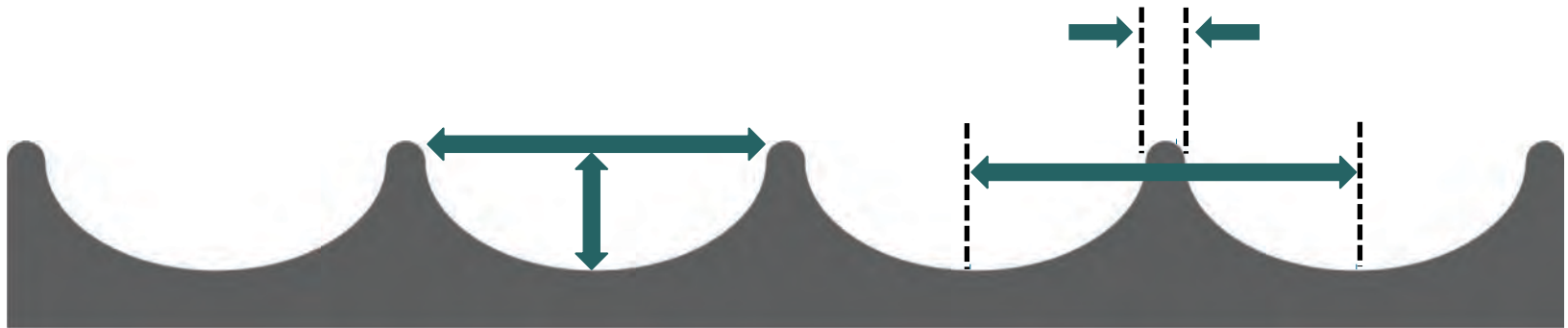


Too deep cell transfer less ink



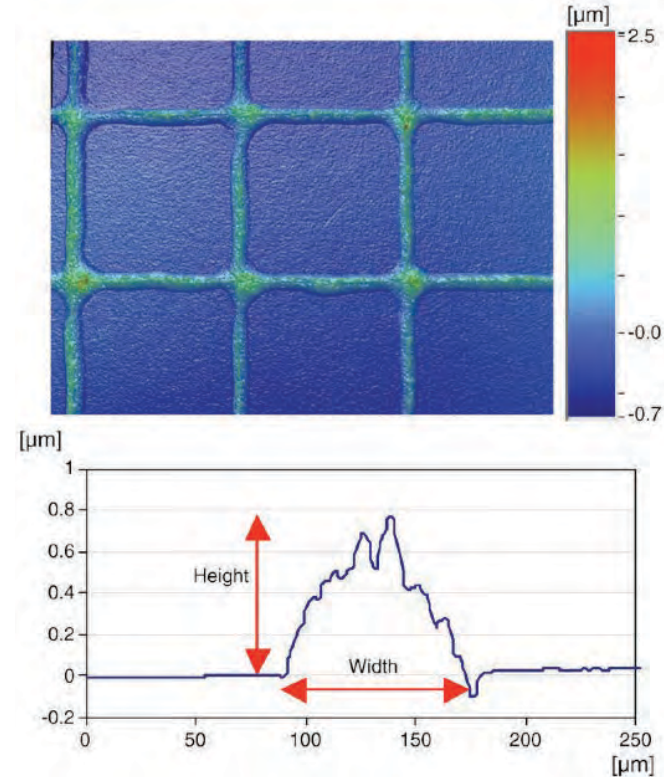
Ideal dimension

- ✓ Depth: Opening ~ 1:3
- ✓ Wall: Cell ~ 1:10
- ✓ Parameters may change according to anilox manufacturer



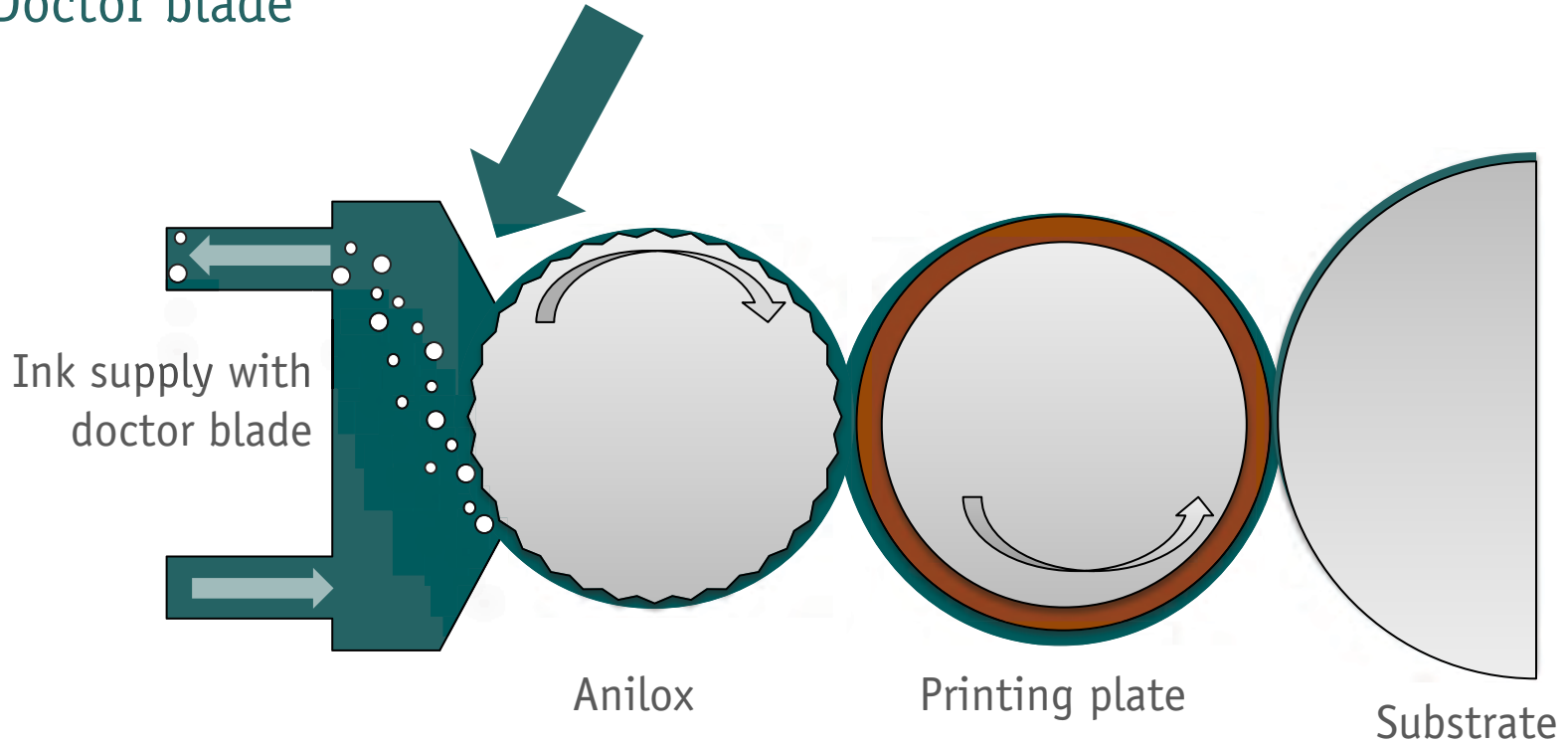
Controlling the thickness

- ✓ Flexibility in control of deposit thickness
 - ✓ The anilox roll is the metering system, independent from plate image
 - ✓ Increasing anilox volume



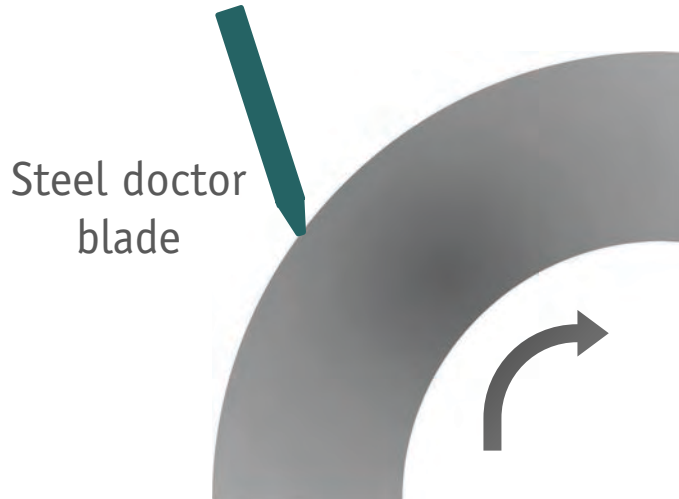
Source: Thin Solid Films 518 (2010) 6113–6116

Doctor blade

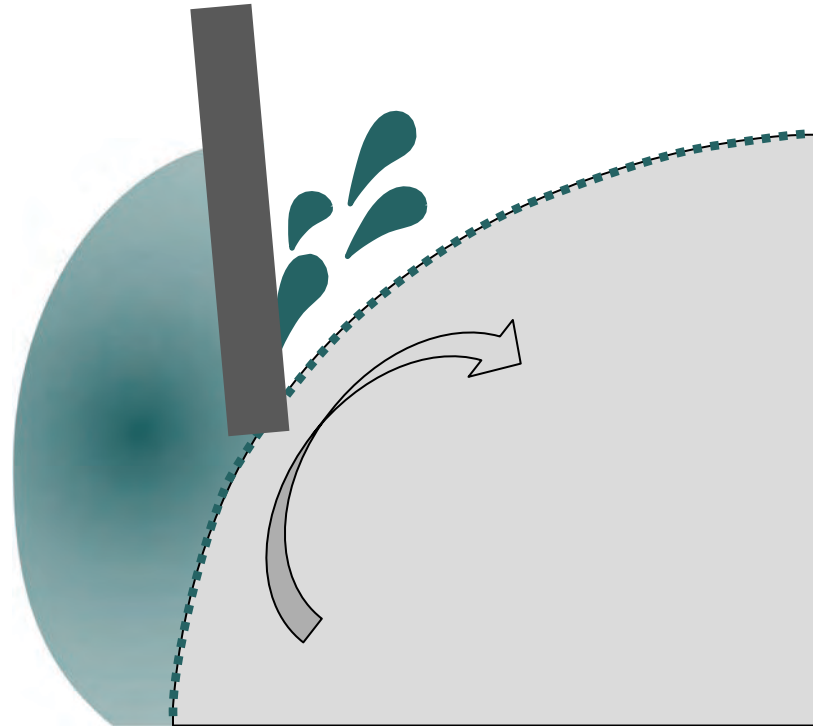


Doctor blade

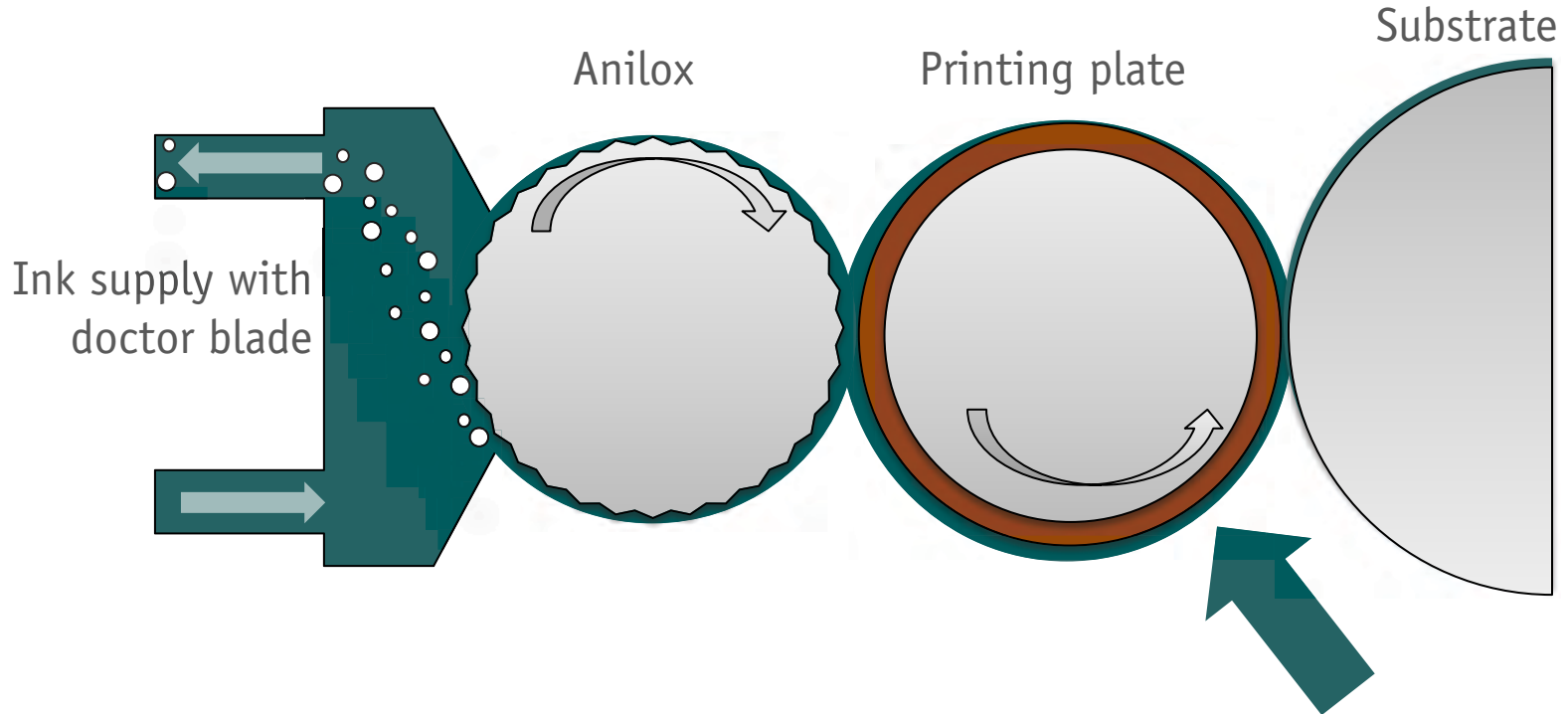
- ✓ Ensures the ink is transferred only by engraved arrears
different designs
- ✓ The only system ensuring repeatable and predictable results



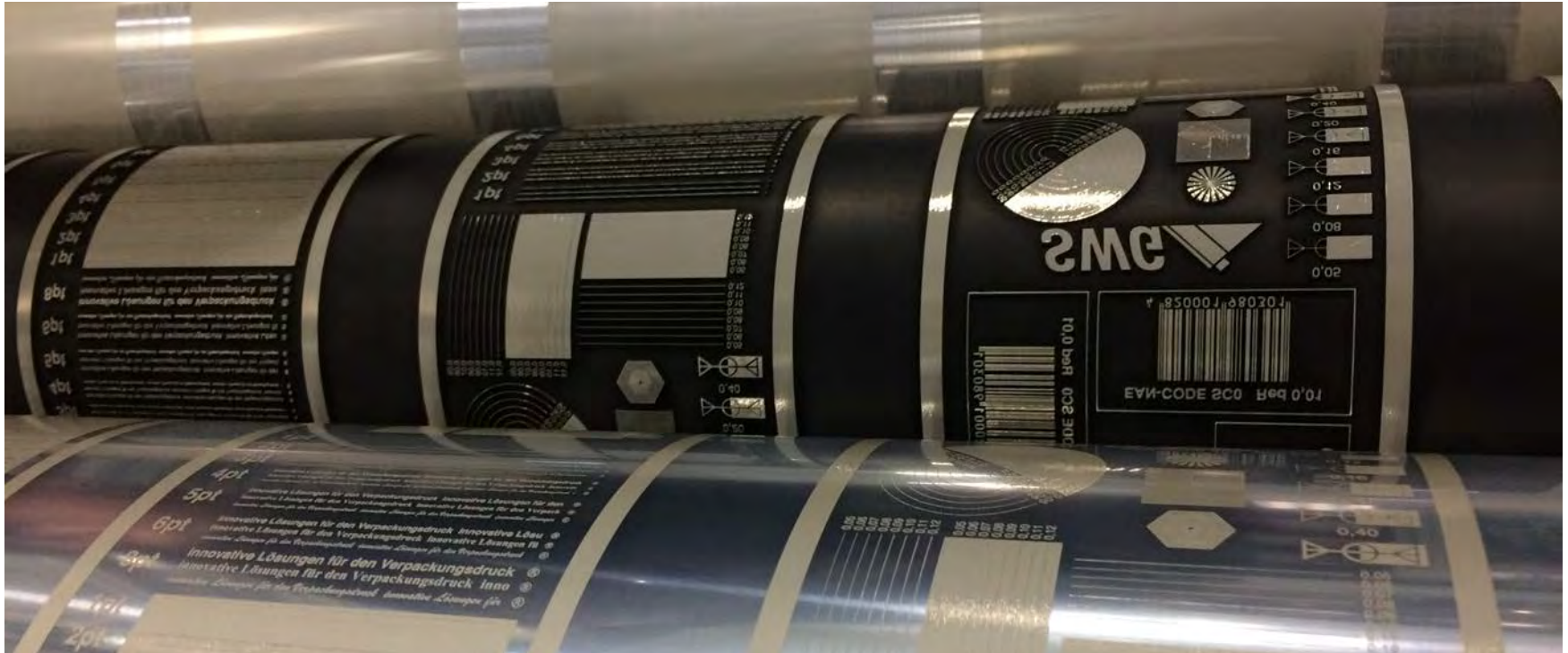
Doctor blade in detail



Printing plate



Printing plate

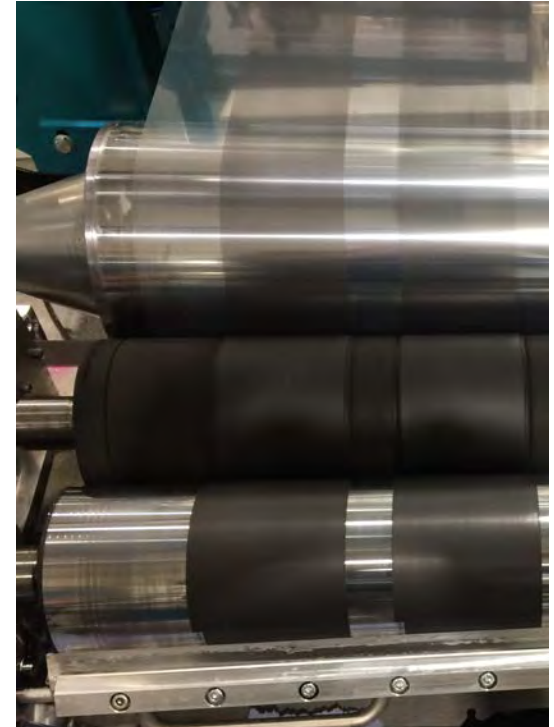


Printing plate

- ✓ Image carrier
- ✓ Soft photopolymer
- ✓ UV exposure creates a raised surface
- ✓ Taped around cylinder/sleeve

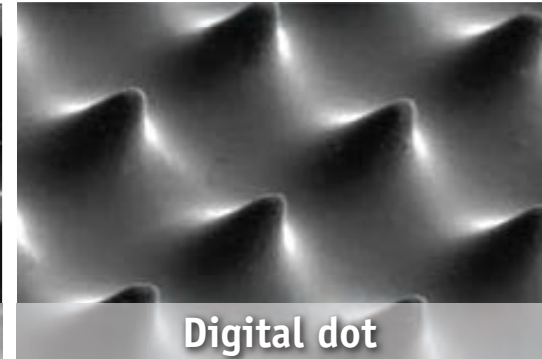
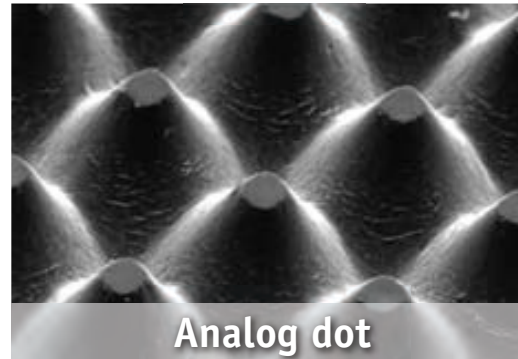
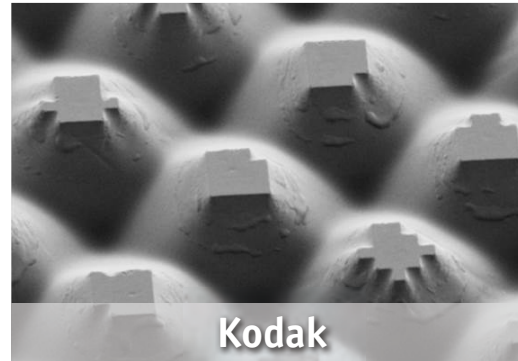
Key improvements

- ✓ Improvements in plate resolution
 - ✓ Various laser masking approaches
- ✓ Direct „in-the-round“ exposure
- ✓ Direct laser engraving of plate
- ✓ Improved materials
 - ✓ Elastomers, chemical resistant photopolymers



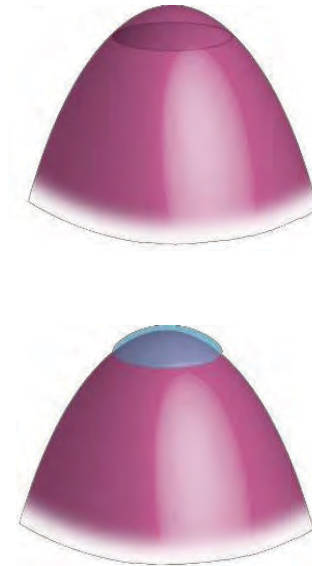
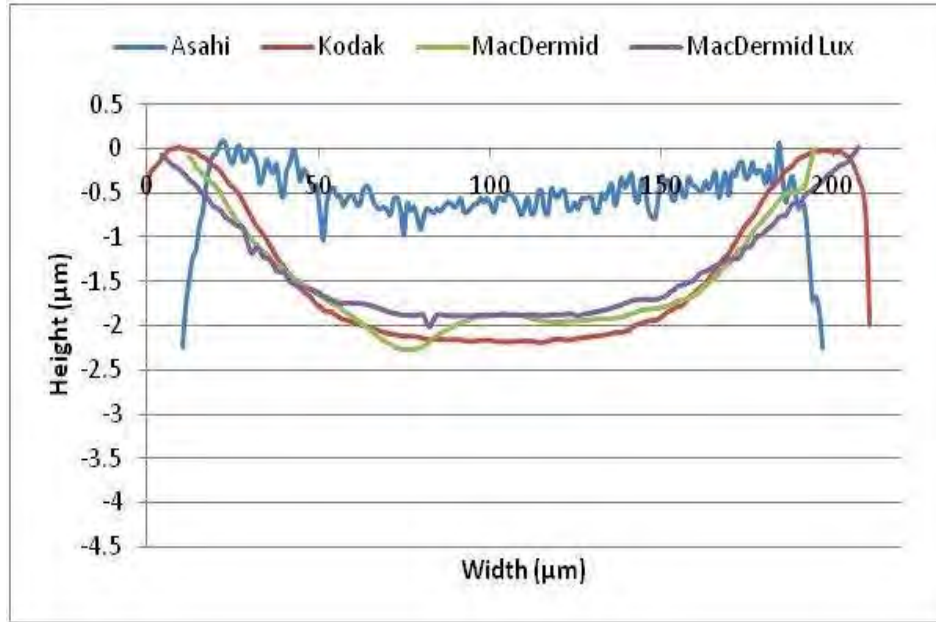
Printing plate designs

Plate design can vary from the manufacturer



Source: 1) www.printweek.in/features/kodak-flexo-plate-technology-spotlight-41227 2) www.flexotechmag.com/key-articles/20525/high-tech-technology-that-s-flexo-plates-today/ 3) www.quintco.com/digital-photopolymer-dots/

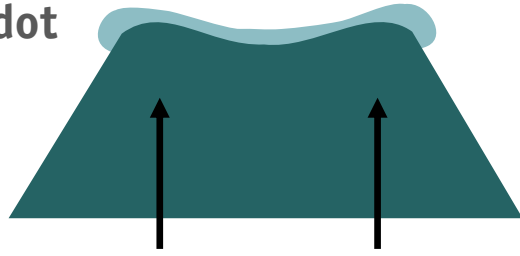
Printing plate designs



Dot profiles at 50% nominal area coverage and 100 lpi line ruling

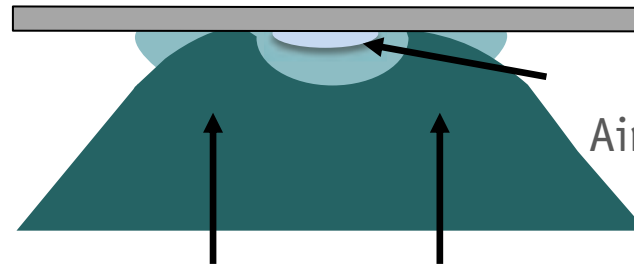
Contact area for printing plate

Ink dot



Cupping edge

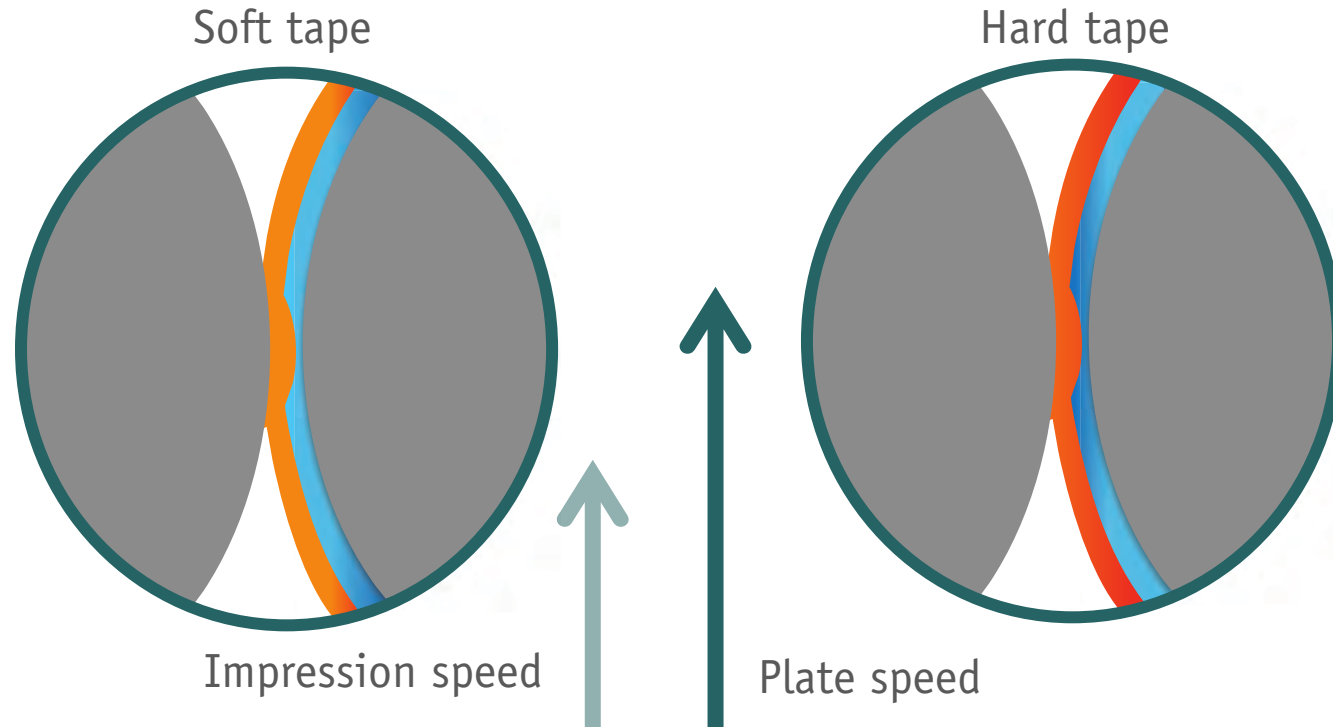
Substrate



Air entrapment

Folding-in of cupping edges

Mounting tape and impression contact



Surface slurring

Smearing of the printed image

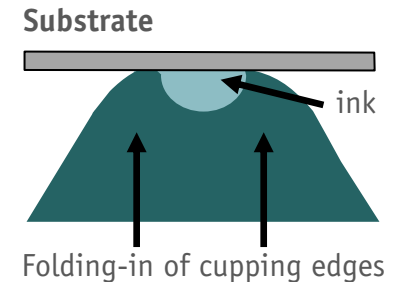
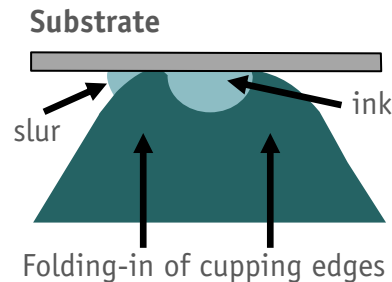
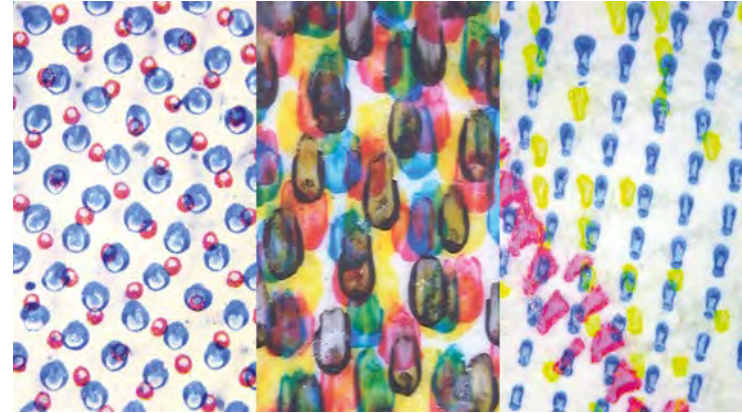
- ✓ Dots are distorted in printed direction
- ✓ Elongated
- ✓ Oval shape
- ✓ Halo of ink

Caused by

- ✓ Impression/slippage between printing plate and substrate
- ✓ Or between anilox and printing plate

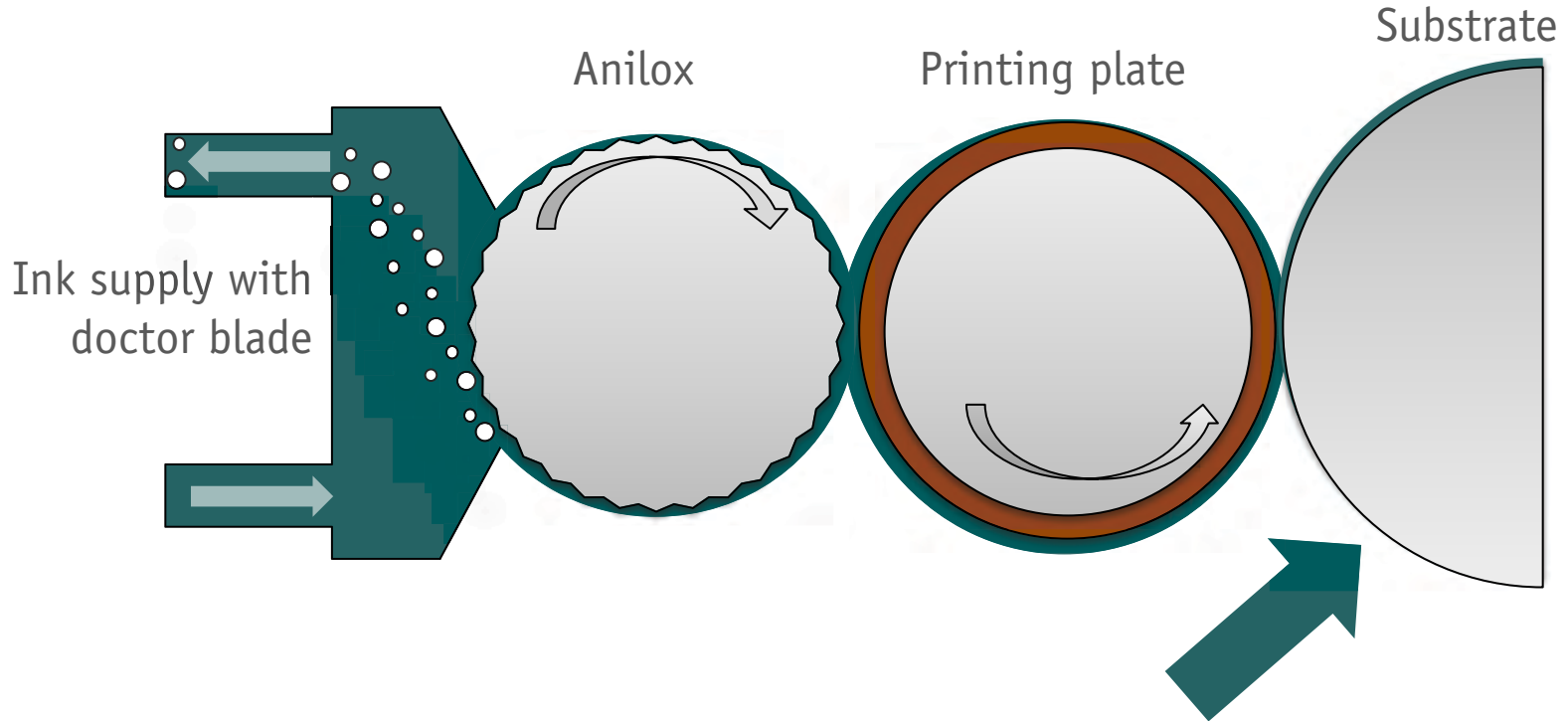
Impression can cause further defects

- ✓ Misregistration
- ✓ Bridging/filling-in

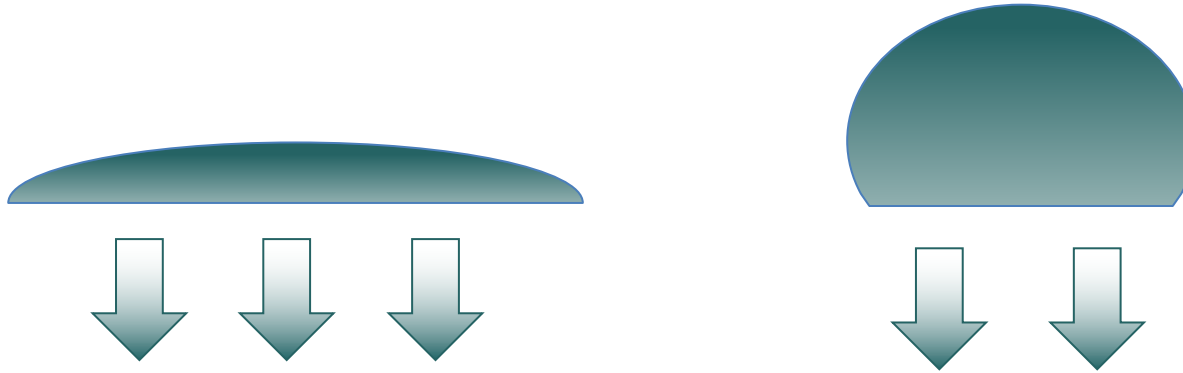


Source: www.flexo.expert/slur-the-sneaky-enemy-of-print-quality/#lightbox/gallery2722

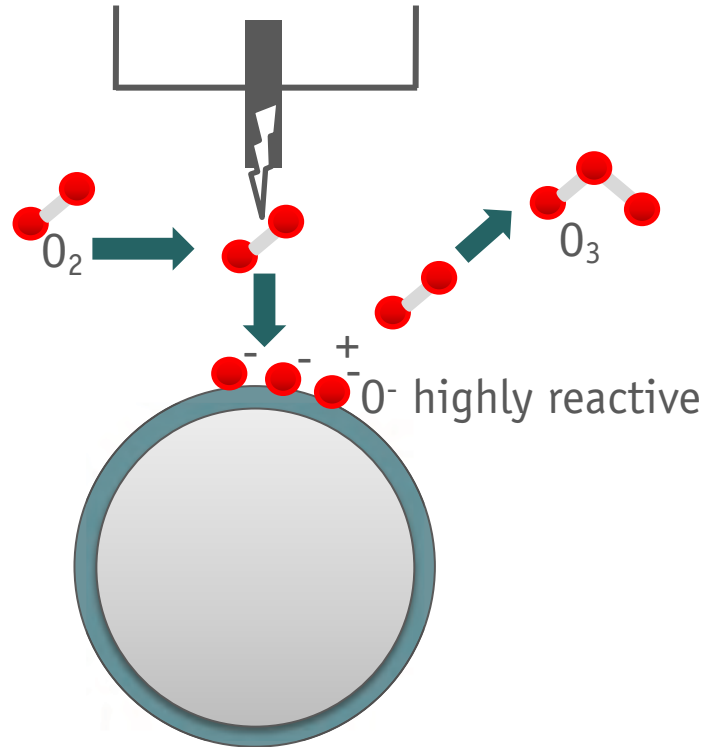
Substrate



Impact surface tension

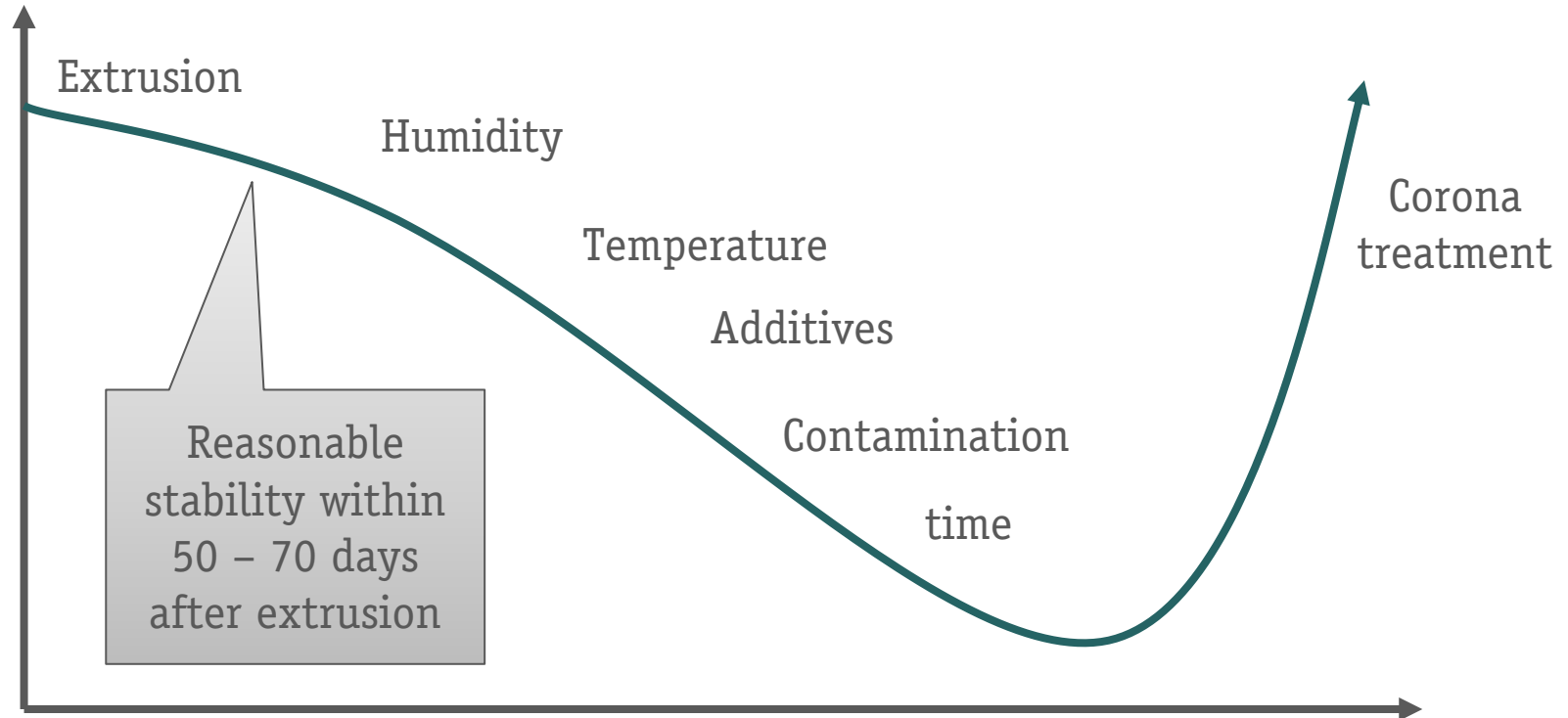


Increasing surface energy by corona treatment



Source: www.vetaphone.com/our-offering/corona-treatment/

Decay of surface energy



Introduction

Motivation

Flexography
printing

Components

Summary

Flexography

- ✓ Ideal R2R patterning for functional materials
- ✓ High resolution
- ✓ Excellent accuracy
- ✓ Good deposition rate and smooth texture
- ✓ Fast & cheap process for high amounts

Do not hesitate to contact us!



Anything missing?

Let us know and we will make it happen!

Our R&D centre is worldwide the most versatile centre for coating, printing and laminating.

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Thank you



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