
TroFILMS
Germany

Digital printing and film lamination

Practical test

Findings, comparison & evaluation

Introduction

Who is TroFilms?

Who is TroFilms?

- TroFilms GmbH produces laminating films for the graphic industry since 2012
- The company processes PP or PET films in different variants and for different requirements
- Company headquarters and production is located in Georgensgmünd/Bavaria
- The products of the company are used worldwide

Why did TroFilms initiate this test series?

- The variety of Digital Printing Technologies, as well as the growth of digital printing processes, poses new challenges and problems for converting, especially print finishing.
- With regard to film lamination, the focus is on compound adhesion, delamination (e.g. due to folding) and optical influences or other structural changes.
- TroFilms initiated this test in order to provide an overview of which digital printing process is best suited to which film types.
  The findings should serve as a recommendation.

Explanation of the testing process

Explanation of the testing process

The base of this test series were sample prints, which were produced using all digital printing processes:

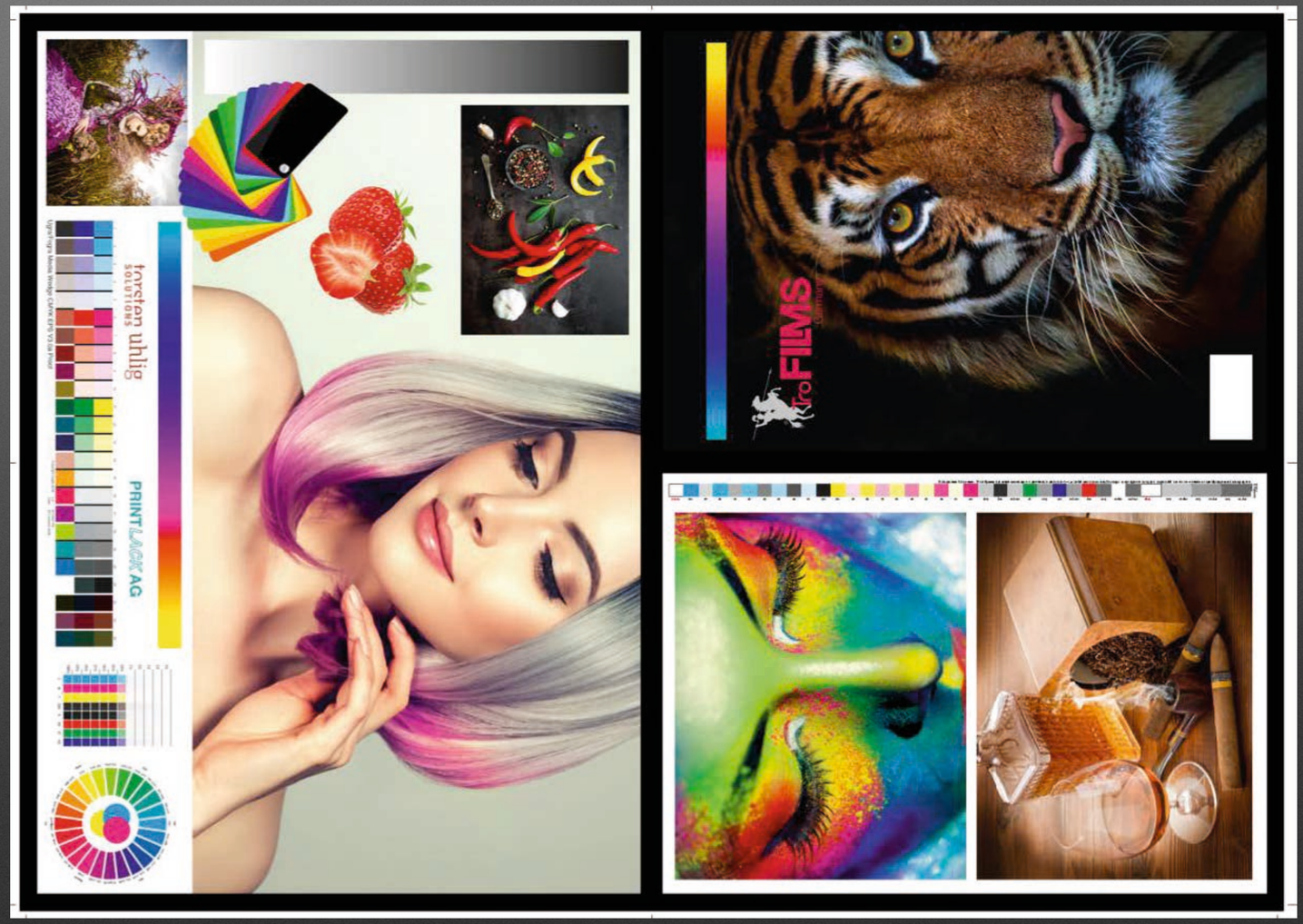
- Dry toner
- Liquid toner
- Water-based inkjet (direct)
- Water-based inkjet (indirect)
- UV based inkjet

Explanation of the testing process

- Substrate: LuxoArt Paper Samt (Papyrus) 150 g/sqm
- Substrate: without primer, i.e. no primer or dye-receiving layer has been applied to the substrate in advance
- Also no subsequent overcoating took place
- The initial parameters for the later lamination tests were therefore always identical!

Printing test form:

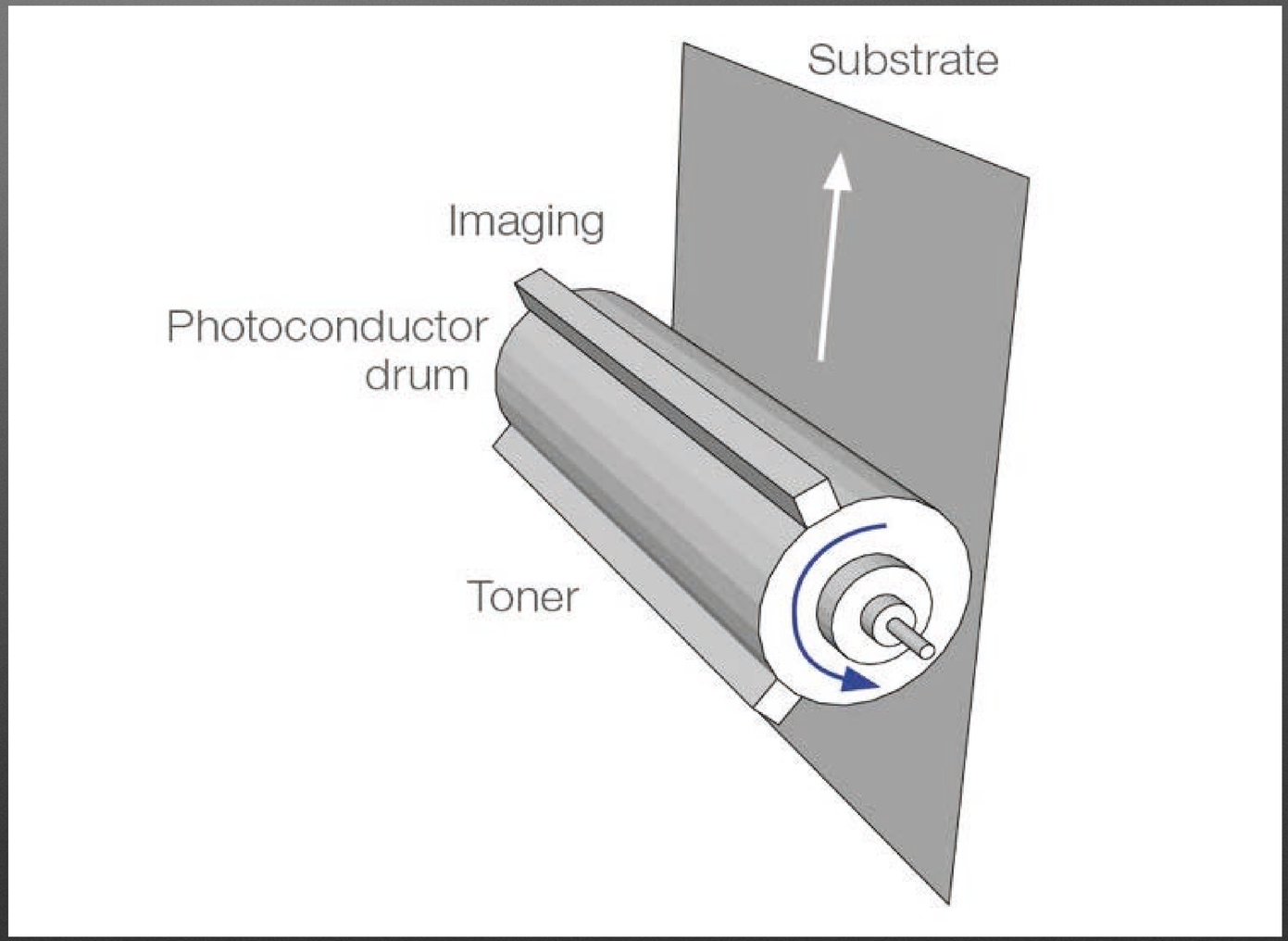
The motif and colour scheme were selected to create the hardest possible test criteria for the film lamination.



Digital printing processes:

1. dry toner

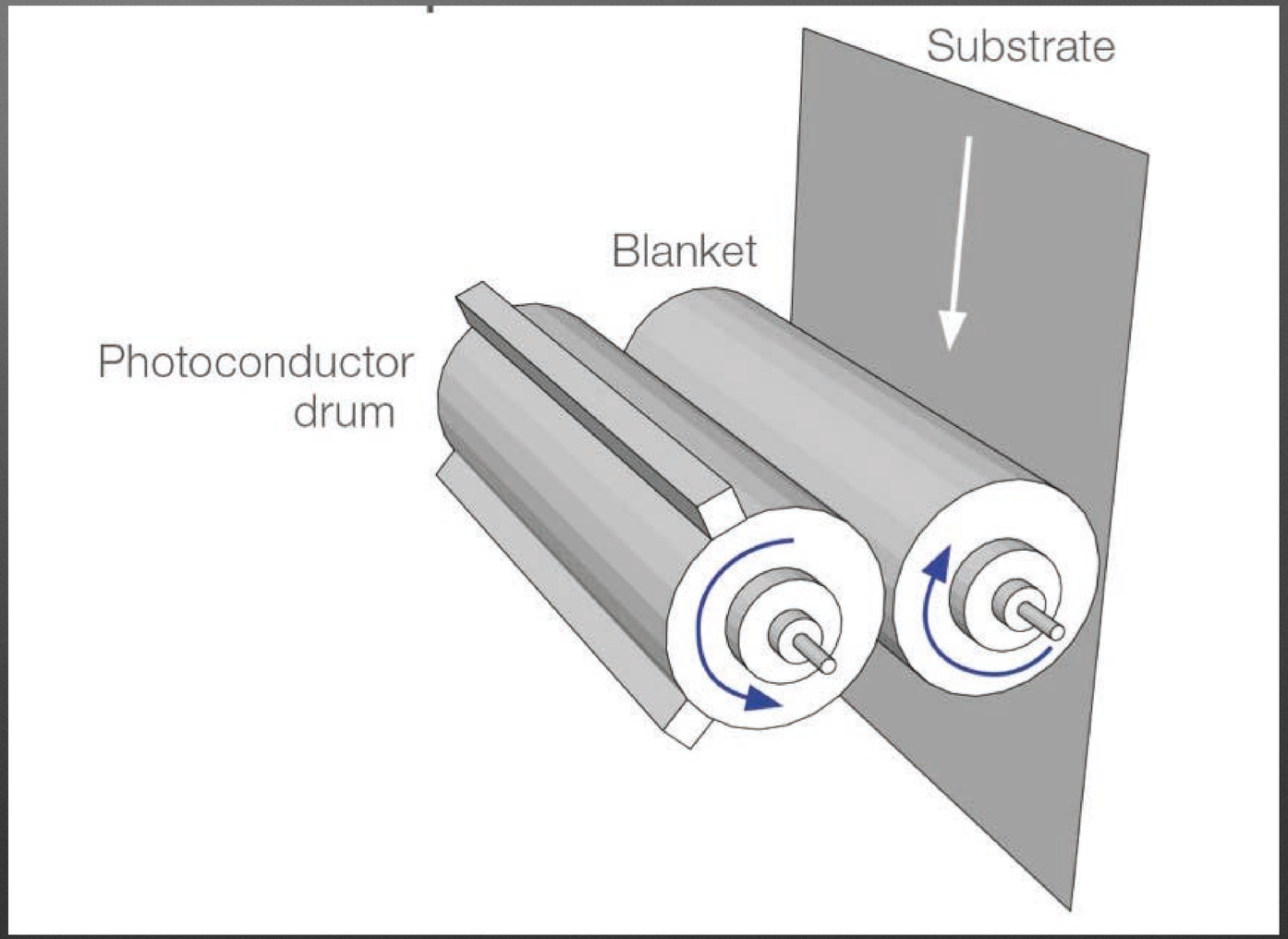
- Toner particles are transferred from the photoconductor drum to the substrate and lie "loose" on the substrate. Only through the heat of the fixing drum the toner particles are fused with the substrate.
- The toner particles have a size of D50 = 8 µm



Digital printing processes:

2. liquid toner

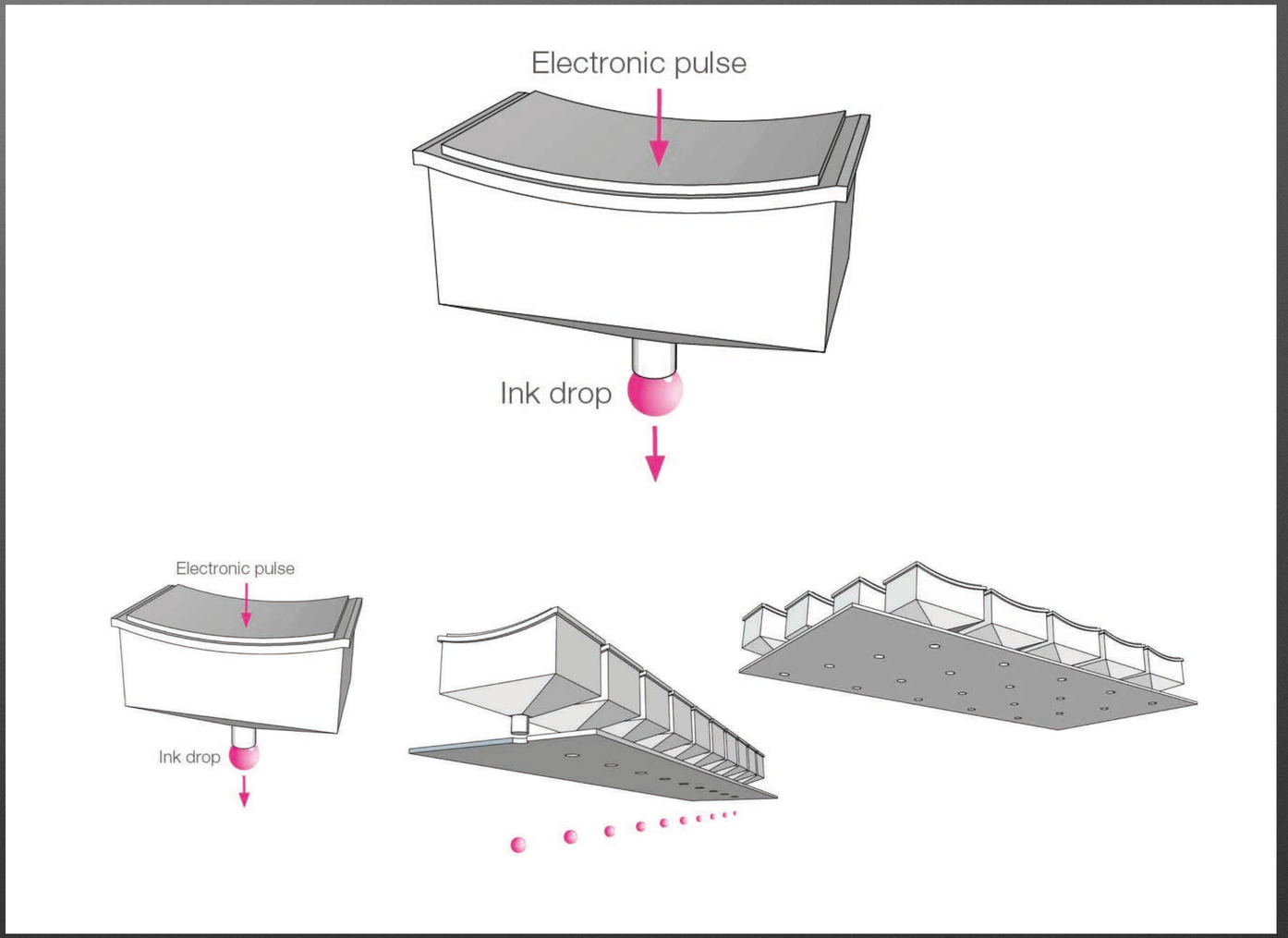
- Toner particles are first dispersed in liquid.
- Transfer takes place indirectly via a blanket cylinder ("offset printing" principle) onto the substrate.
- The functional principle is otherwise largely similar to the dry toner process.
- The toner particles have a size of D50 = 2 µm



Digital printing processes:

3. inkjet

- In contrast to the toner processes, the inkjet uses low-viscosity inks (water-based or UV-based), which are applied to the substrate via the print head - by using the nozzles contained therein.
- The respective format width is covered by print head cascades (print bars).



Digital printing processes:

3. inkjet - water-based / direct

- The ink is applied directly to the substrate.
- Water-based inks have a tendency to penetrate, so this process often requires a primer or ink-receiving layer to be applied to the substrate.

Digital printing processes:

4. inkjet - water-based / indirect

- The ink is first applied to a blanket.
- From the blanket the print image is transferred to the substrate, similar to the principle of "offset printing".
- No primers or ink receiving layers are necessary with this process.

Digital printing processes:

5. inkjet - UV-based / direct

- Similar to water-based direct inkjet printing, the ink is also applied directly to the substrate in UV inkjet printing.
- Since UV systems are cured directly and contain a higher proportion of solids, the ink droplet does not penetrate or flow, i.e. primers and ink receptive layers are not necessary.

Involved companies

Process management:

Supervision and preparation of the test series was kindly supported by:

- Torsten Uhlig Solutions, Porta Westfalica

Realization:

The printing of the 5 different digital versions was kindly supported by:

- Dry Toner / XEROX Iridesse → Straub Druck (Schramberg)
- Liquid toner / HP INDIGO 12.000 → Straub Druck (Schramberg)
- Water-based inkjet / FUJI Jetpress 750 → Straub Druck (Schramberg)
- Water-based inkjet (indirect) / LANDA S10 → Birkhäuser (CH-Reinach)
- UV inkjet / KOMORI Impremia IS29 → Weidmann (Hamburg)

Finishing:

The finishing of the 5 different digital versions was done with the kind support of:

- Klüter Druckveredelung, Bünde
- Printlack AG, Schwadernau

Examination:

The examination of the compound values was performed with the kind support of:

- WEILBURGER Graphics GmbH, Gerhardshofen

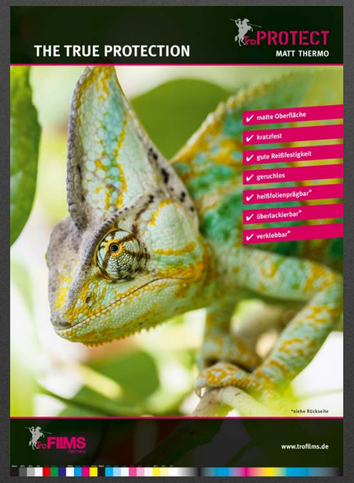
TroFilms thanks all supporters
for the excellent cooperation!

Test procedure

Thermal film lamination:

Since wet film lamination is not possible on digital toners and inks, only thermal films were used for this test series.

TroFilms selected 6 different films for the test:



TroPROTECT THERMAL

TroPROTECT-X THERMAL

TroPROTECT-X DIGITAL

TroTEMPTATION THERMAL

TroTEMPTATION-X THERMAL

TroTEMPTATION-X DIGITAL

Thermal film lamination:

- The lamination was done on a TPM Katana 76
- Temperature 113 °C
- Print settings identical for all test series
- Scope → 5 digital printing technologies x 6 thermal foil types = 30 results

The lamination was done with the kind support of PrintLack in Schwadernau/CH

Test evaluation

Test evaluation:

The 30 results were evaluated by the following tests:

- Folding test
- Compound values
- Blind embossing

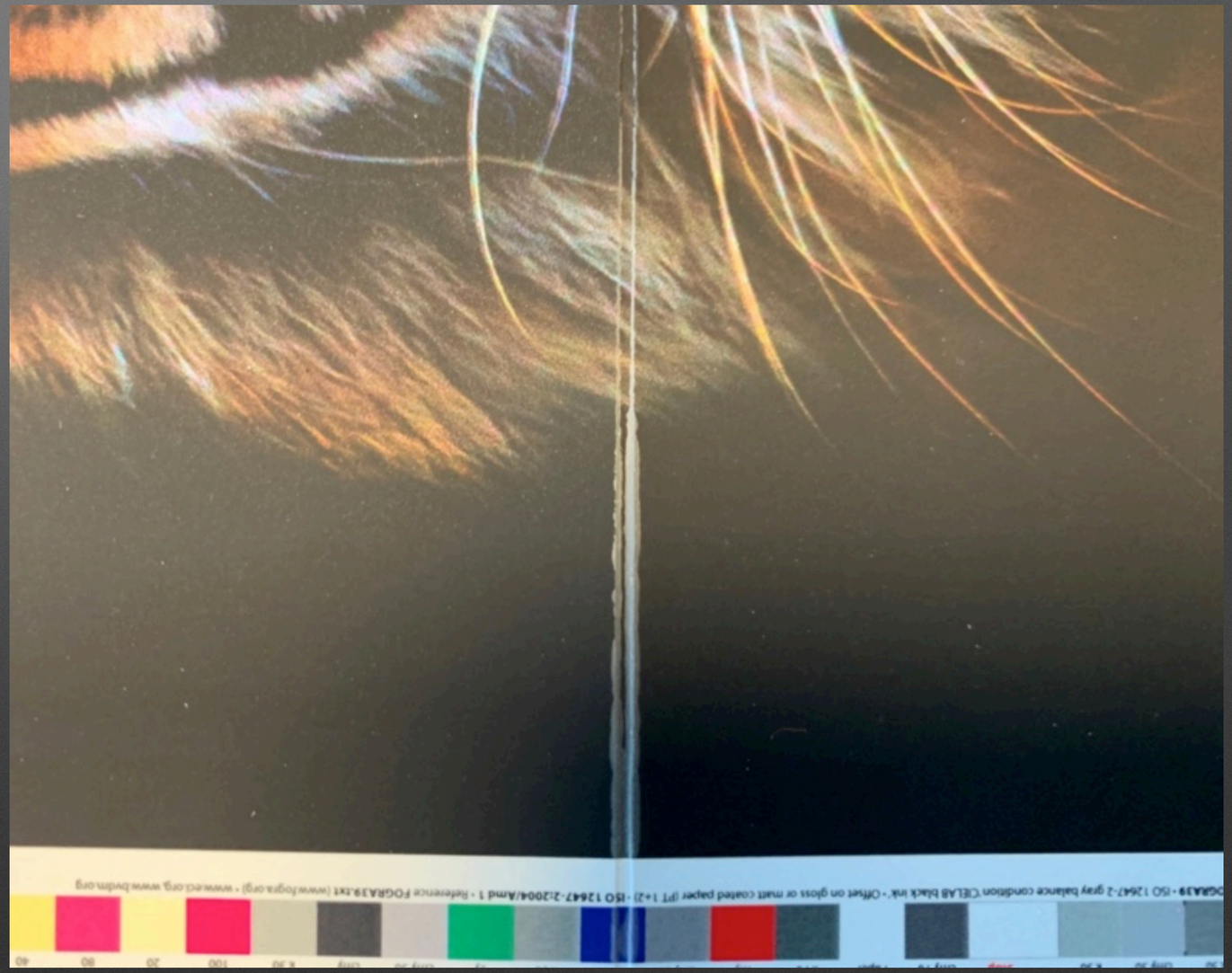
Folding test

Folding test:

- Manual creasing on Creaser Perforator GPM 315
- Evaluation of results after multiple stresses and strains

Folding test:

Example for result rating "unsatisfactory"



Folding test result table:

	Liquid toner	Dry toner	UV inkjet	WB inkjet direct	WB inkjet indirect
PROTECT Thermal	✔	–	✔	✔	✔
PROTECT-X Thermal	✔	–	✔	✔	✔
PROTECT-X Digital	–	–	✔	✔	✔
TEMPTATION Thermal	–	–	✔	–	✔
TEMPTATION-X Thermal	✔	–	✔	–	✔
TEMPTATION-X Digital	–	–	✔	✔	✔

Compound values

Compound values:

This test was carried out in accordance with DIN 53357, which is no longer valid.

Since there is currently no other meaningful test method, the compound values were determined using this procedure!

- Testing device Universal testing machine 500N Zwicki (Z 0.5)
- Deduction angle 180°
- Value N/15 mm test strip width

Compound values:

The compound values were determined:

- ...on low ink coverage
- ...on high ink coverage
- ...always at the identical places of the print motif, for all test samples, in order to achieve direct comparability.

The measurement was performed 4 times, the average value was entered in the table.

The compound values were determined with the kind support of WEILBURGER Graphics GmbH

Compound values Protect:

	Liquid toner	Dry toner	UV inkjet	WB inkjet direct	WB inkjet indirect
PROTECT Thermal					
Compound value low ink coverage	3.88	1.97	3.57	2.33	3.63
Compound value high ink coverage	3.37	0.46	2.08	0.68	2.82
PROTECT-X Thermal					
Compound value low ink coverage	2.33	1.97	3.85	1.93	4.35
Compound value high ink coverage	1.64	0.26	1.86	1.67	3.32
PROTECT-X Digital					
Compound value low ink coverage	1.05	3.45	5.06	4.99	4.87
Compound value high ink coverage	0.07	0.46	2.55	3.32	4.44

Compound values Temptation:

	Liquid toner	Dry toner	UV inkjet	WB inkjet direct	WB inkjet indirect
TEMPTATION Thermal					
Compound value low ink coverage	1.47	2.47	2.95	1.44	2.33
Compound value high ink coverage	0.86	0.95	1.86	0.56	1.47
TEMPTATION-X Thermal					
Compound value low ink coverage	1.53	4.20	2.09	1.92	1.47
Compound value high ink coverage	1.06	0.71	1.12	1.25	1.35
TEMPTATION-X Digital					
Compound value low ink coverage	1.33	2.47	4.57	2.02	4.00
Compound value high ink coverage	0.34	0.35	2.29	2.42	3.51

Compound values:

Since there has never been such an evaluation in this form before, it is not possible to determine which values guarantee sufficient bonding and which values do not.

In tendency, however, this statement is correct:

- The higher the determined value (in N/15 mm → deduction angle 180°)
- the more secure the bond

A final assessment is only possible if the results of all 3 test methods are considered together!

Embossability

Embossability:

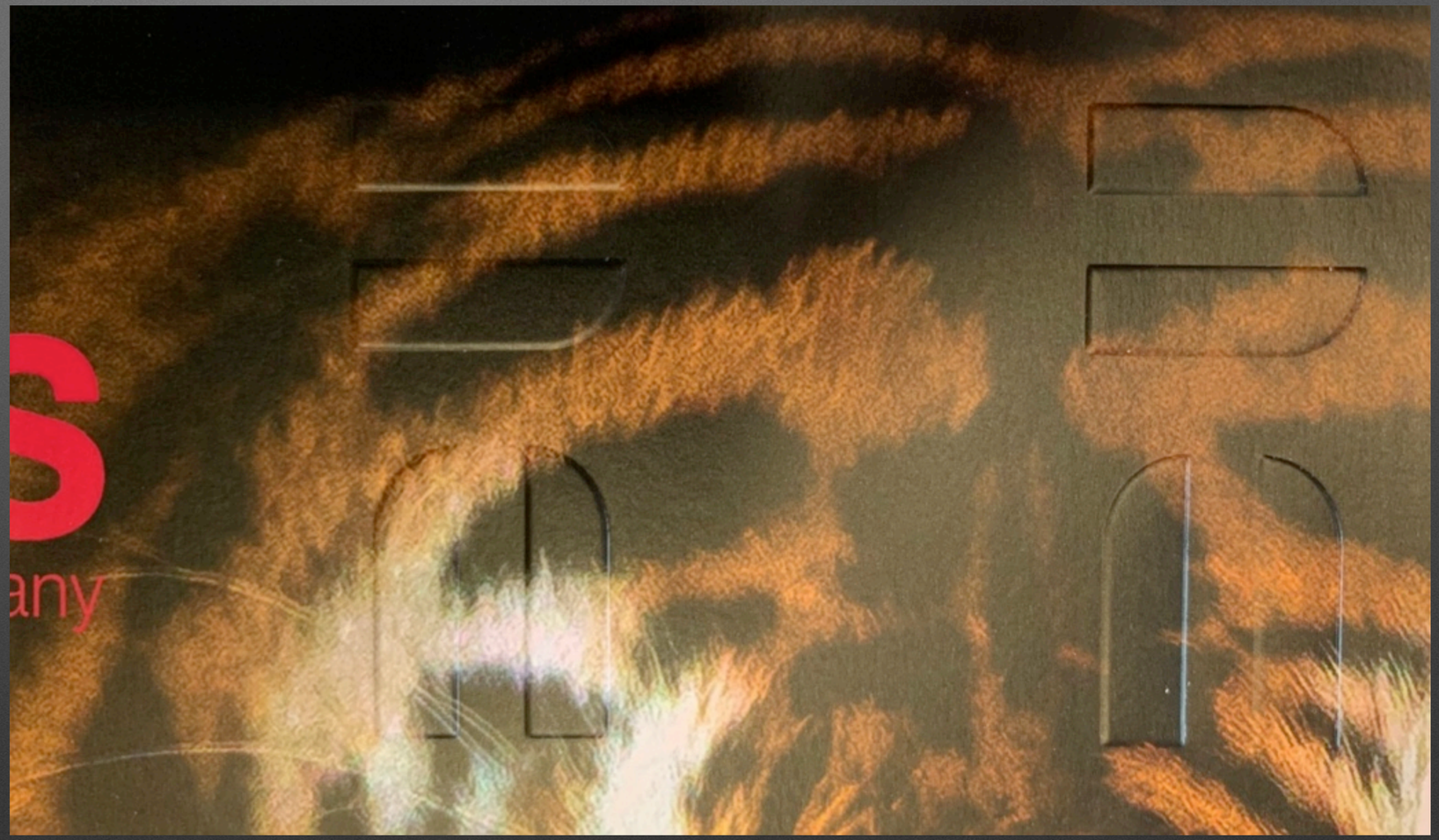
- Embossing machine G.L. Instruments
- 6.2 bar pressure for 5 sec
- Embossing test 1 at room temperature
- Embossing test 2 when heated to 40 °C

Embossability:

Example for result rating "unsatisfactory"

Embossability:

Example for result rating "good"



Embossability PROTECT:

		Liquid toner	Dry toner	UV inkjet	WB inkjet indirect	WB inkjet direct
PROTECT Thermal	1. embossing test / 22 °C low ink coverage	✔	✔	✔	✔	✔
	1. embossing test / 22 °C high ink coverage	✔	✔	✔	✔	✔
	2. embossing test / 40 °C low ink coverage	✔	–	✔	–	–
	2. embossing test / 40 °C high ink coverage	✔	–	✔	–	–
PROTECT-X Thermal	1. embossing test / 22 °C low ink coverage	✔	–	✔	✔	✔
	1. embossing test / 22 °C high ink coverage	✔	–	✔	–	✔
	2. embossing test / 40 °C low ink coverage	✔	–	✔	–	–
	2. embossing test / 40 °C high ink coverage	–	–	✔	–	–
PROTECT-X Digital	1. embossing test / 22 °C low ink coverage	✔	–	✔	✔	✔
	1. embossing test / 22 °C high ink coverage	–	–	✔	✔	✔
	2. embossing test / 40 °C low ink coverage	–	–	✔	✔	✔
	2. embossing test / 40 °C high ink coverage	–	–	✔	✔	✔

Embossability TEMPTATION:

		Liquid toner	Dry toner	UV inkjet	WB inkjet indirect	WB inkjet direct
TEMPTATION Thermal	1. embossing test / 22 °C low ink coverage	✔	✔	✔	–	✔
	1. embossing test / 22 °C high ink coverage	–	✔	✔	–	✔
	2. embossing test / 40 °C low ink coverage	–	✔	✔	–	–
	2. embossing test / 40 °C high ink coverage	–	–	✔	–	–
TEMPTATION-X Thermal	1. embossing test / 22 °C low ink coverage	✔	✔	✔	✔	✔
	1. embossing test / 22 °C high ink coverage	–	✔	–	–	–
	2. embossing test / 40 °C low ink coverage	✔	–	–	✔	–
	2. embossing test / 40 °C high ink coverage	–	–	–	–	–
TEMPTATION-X Digital	1. embossing test / 22 °C low ink coverage	✔	✔	✔	✔	✔
	1. embossing test / 22 °C high ink coverage	✔	–	✔	✔	✔
	2. embossing test / 40 °C low ink coverage	–	–	✔	✔	✔
	2. embossing test / 40 °C high ink coverage	–	–	✔	✔	✔

Conclusion

Conclusion:

- This series of tests confirms the complexity of the topic "finishing of digital prints" mentioned at the beginning.
- The thermal lamination properties show clear differences.
- The toner processes, especially dry toner, are much more critical than the inkjet processes.

Summary

Summary:

	PROTECT Thermal	PROTECT-X Thermal	PROTECT-X Digital	TEMPTATION Thermal	TEMPTATION-X Thermal	TEMPTATION-X Digital
Dry toner						
Liquid toner						
UV inkjet						
WB inkjet direct						
WB inkjet indirect						

Résumé

Résumé:

- The results were strongly influenced by the amount of ink coverage!
- This problem was much more evident in the toner processes, especially in the dry toner process with 100% black ink coverage.

Thank you very much for your attention!