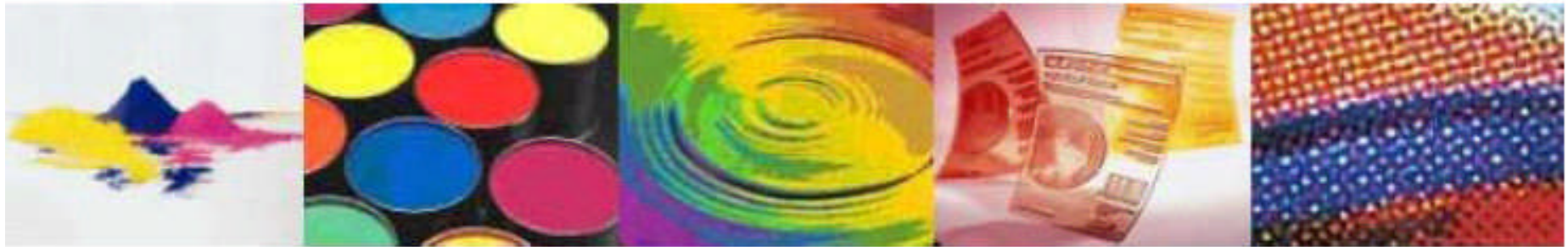


Rich Emmerling

Accounts Manager



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Plate Construction: Using Statistical Designed of Experiments (DOE'S)

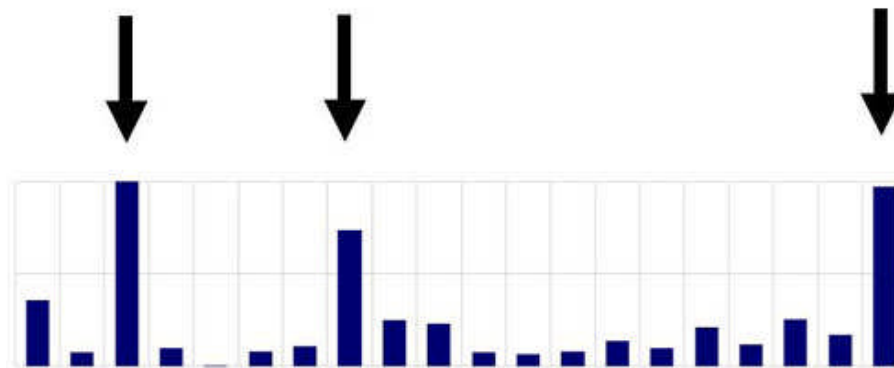
Plate & Cushion Tape Optimization

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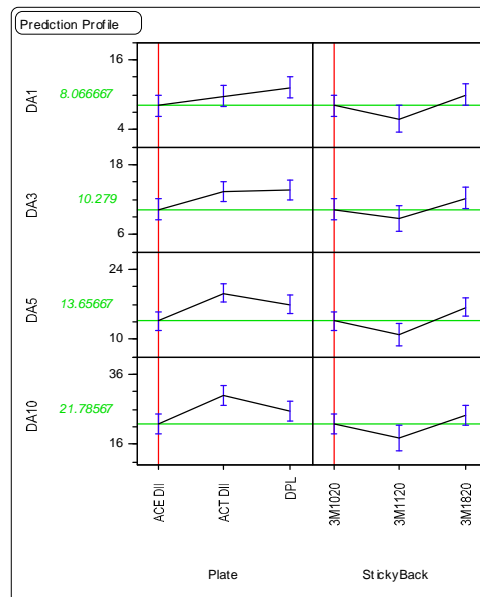
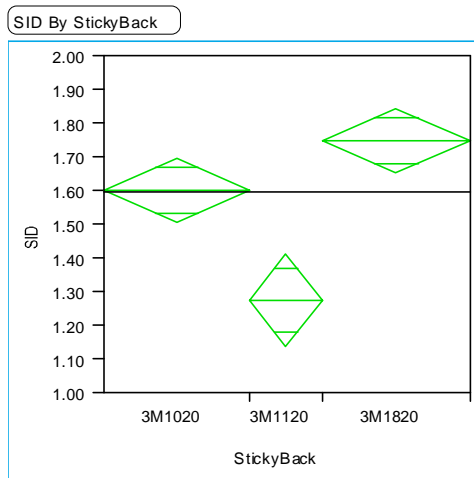
Overview

- Benefit To The Tradehouse
- Design Of Experiments (DOE'S)
 - DOE Defined
 - Why Use DOE'S
 - Tradeoffs / Compromises
- nyloflex® Plate Construction And Cushion Tape Optimization
- Past DOE's
- Possible Applications
- Planning For A DOE



Design of Experiment

- DOE'S evaluation of the variables and interactions.
- Provides a clear understanding of each variables effect on the desired result.
- Suggests follow-up trials to obtain even better results.



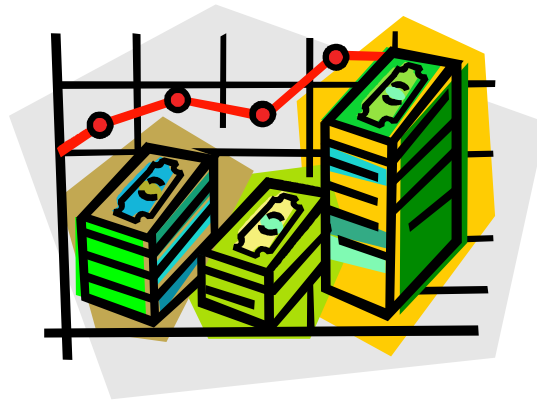
Trade Shop Benefit

- Provide efficiencies in translating customer requirements into reality.
- That leads to customer satisfaction and trust in your service and performance.



Save Time and Costs

- Maximum information while minimizing the amount of expended effort.
- A series of short trials with the end result of not leaving any "stone unturned" in your evaluation.



Why Use Designed Experiments?

- Printing involves many trade-offs.
- Some variables may lead to optimum ink lay down, but may also have a negative effect on image fidelity.
- Compromises may be necessary to obtain the optimum quality for the customer.



Why Use (DOE's)

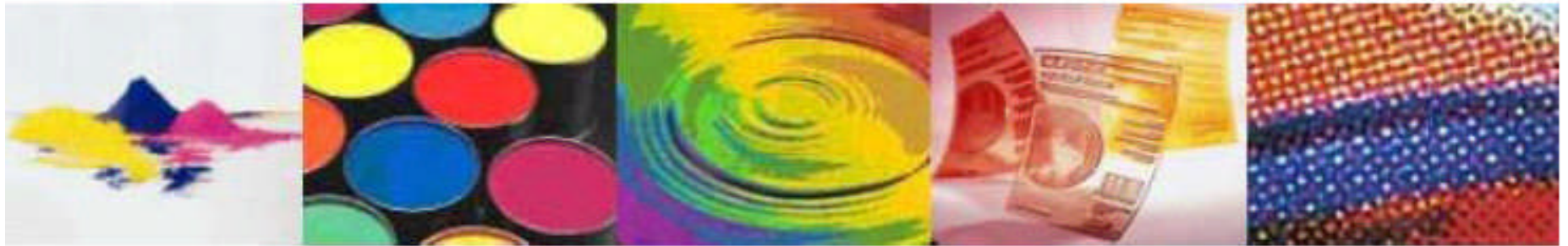
- Efficient way of evaluating the effect of multiple factors.
- These experiments explore the total experimental space.
- They are much more efficient than the single factor at a time approach.



Possible Applications

- Press characterization
- Banded anilox tests
- Ink selection
- Prove a point
- Optimum plate construction

nyloflex® Plate Construction and Cushion Tape Optimization



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Purpose

- Provide guidance on the optimum plate construction (plate / cushion tape) for flexible packaging.
- Define combination printing parameters using flexible packaging conditions on film with solvent based inks.



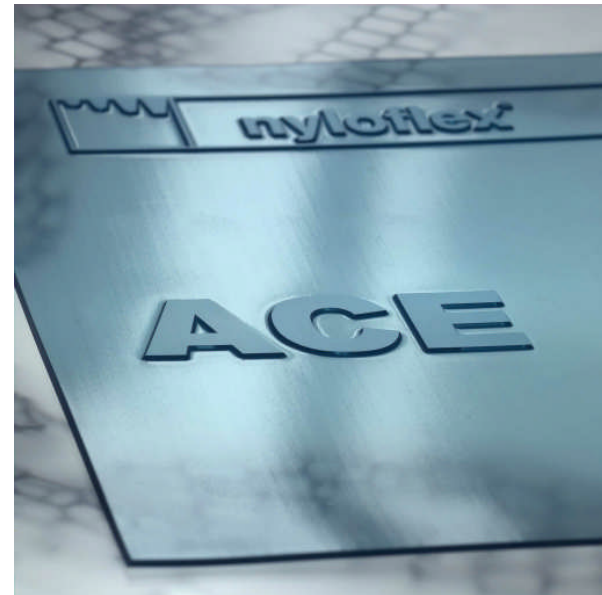
Variables – Plates & Cushion Tape

Plates – Digital (0.067”)

- nyloflex ACE & ACT
- competitive plate

Cushion Tape – (3M 0.020”)

- 1120
- 1020
- 1820



Trial List

2 - Variables
3 - Levels (3²)

<u>Trial</u>	<u>Plate</u>	<u>Stickyback</u>
1	ACE DII	3M1120
2	ACE DII	3M1820
3	Comp.	3M1820
4	ACT DII	3M1820
5	ACE DII	3M1020
6	ACT DII	3M1120
7	Comp.	3M1120
8	ACE DII	3M1820
9	ACT DII	3M1820
10	Comp.	3M1820
11	ACT DII	3M1020
12	ACT DII	3M1020
13	ACE DII	3M1020
14*	Comp.	3M1120
15*	ACT DII	3M1120
16	Comp.	3M1020
17	Comp.	3M1020
18*	ACE DII	3M1120

* Eliminated during the print trial.

Press Conditions

Press – PCMC Avanti (Fox Valley Technical College)

Anilox – Cyan 800 lpi / 2.34 bcm

Ink – Flint IK310 solvent based (cyan and white)

Viscosity – 30 seconds #2 Zahn (cyan)

Press Speed – 750 ft / min.

Substrate - Polypropylene

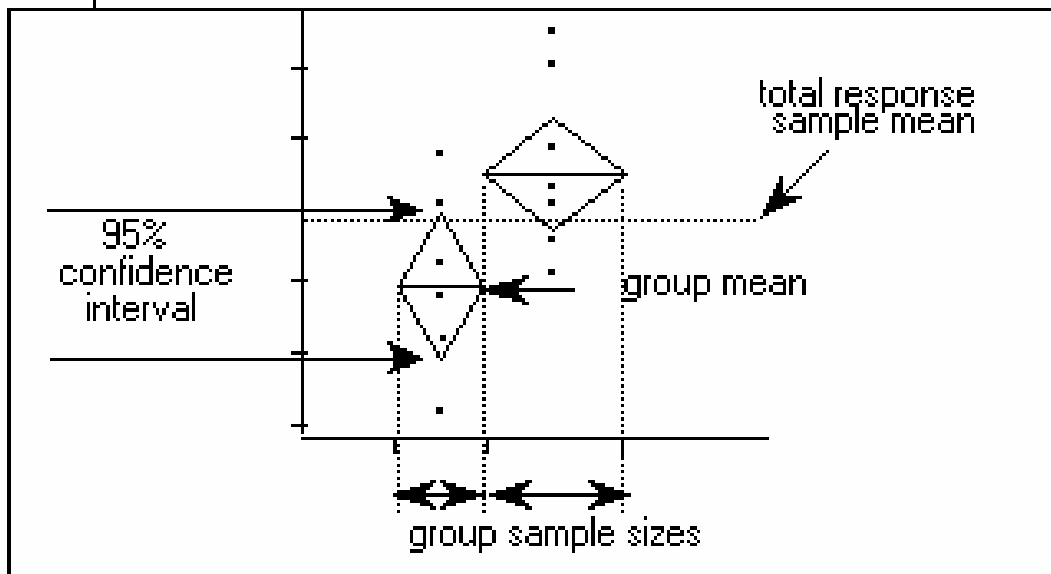


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Means Diamonds

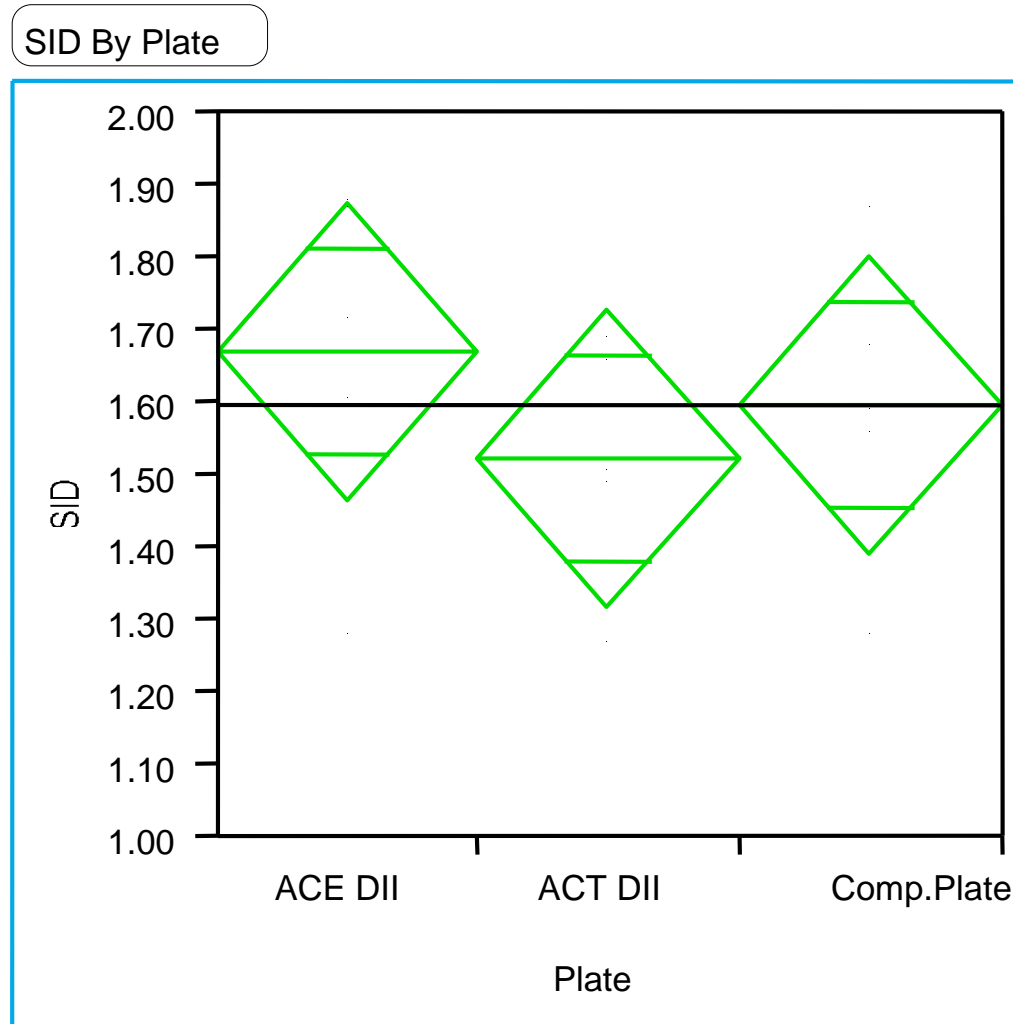
Means Diamonds

Means diamonds are a schematic of the mean and standard error of the mean for each sample group. The line across each diamond represents the group mean. The height of each diamond represents the 95% confidence interval for each group, and the diamond width represents the group sample size.



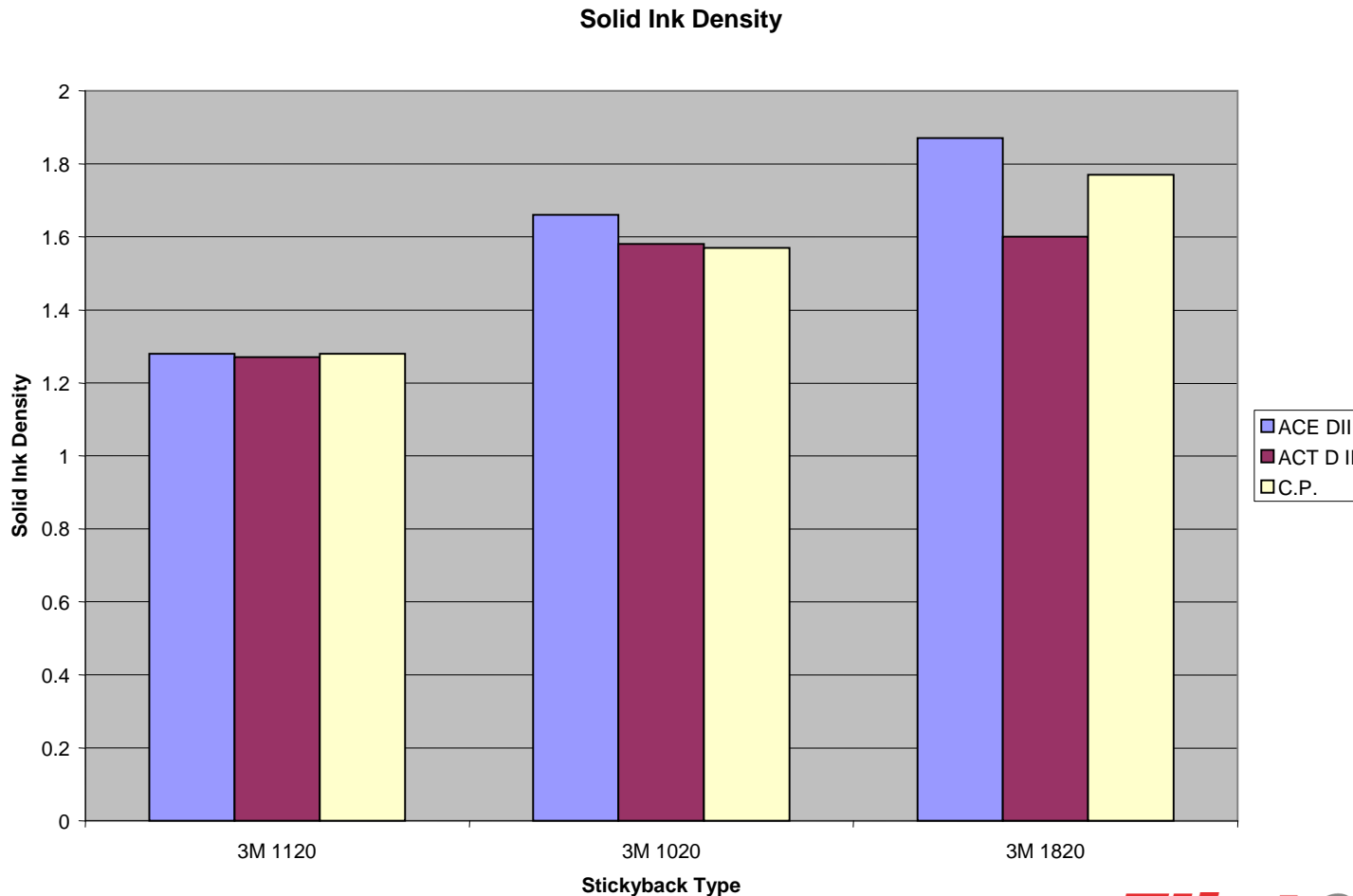
Solid Ink Density (Plate)

- Plate type had minimal effect on SID



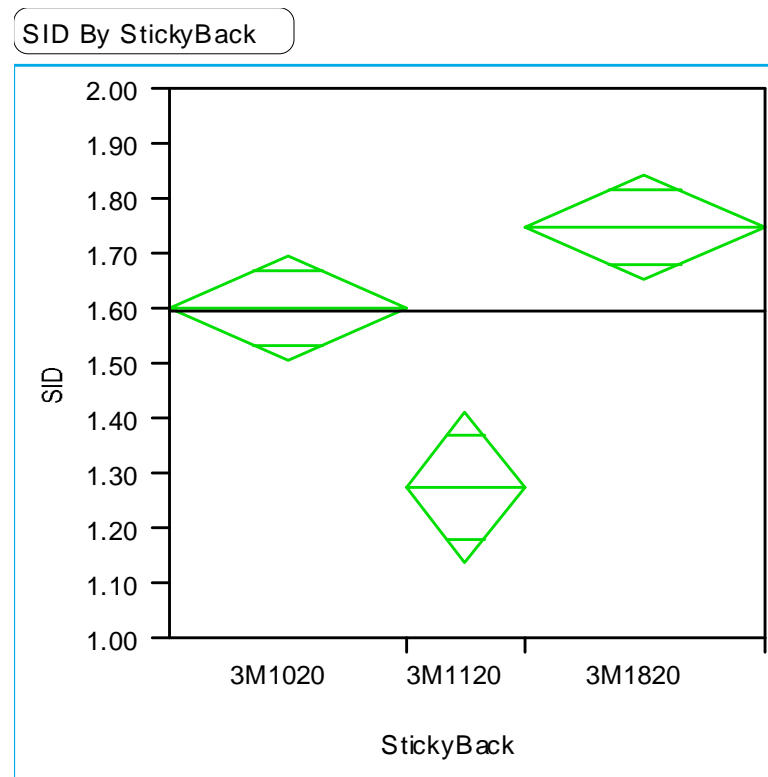
SID Sorted by Stickyback

- Plate type had minimal effect on SID

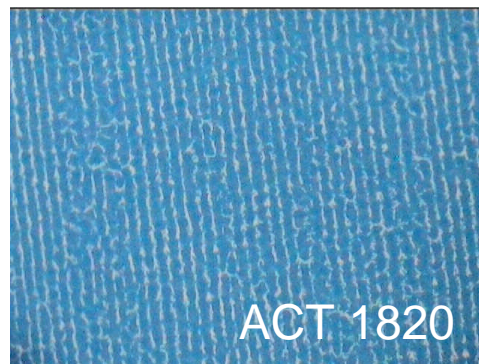
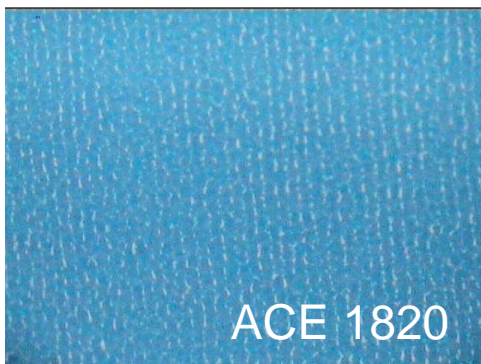
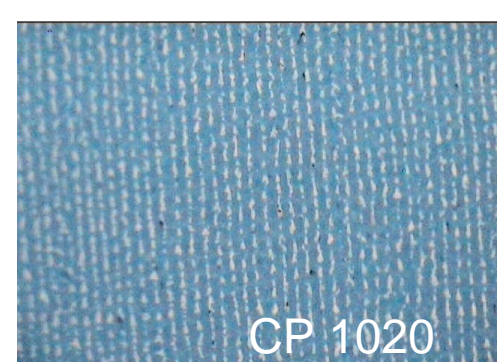
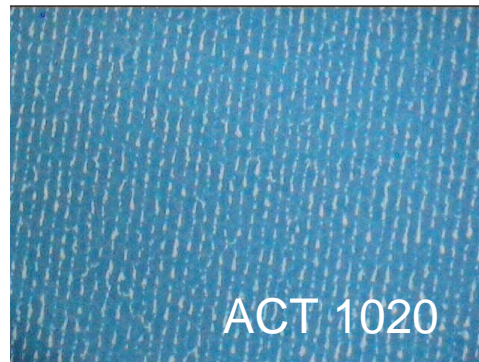
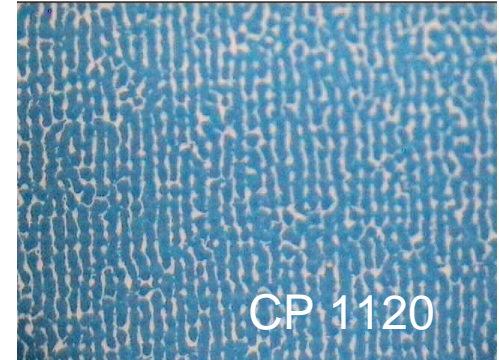
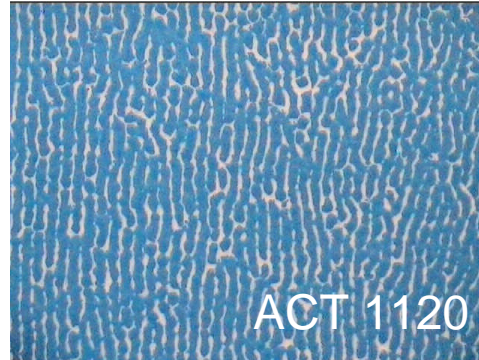
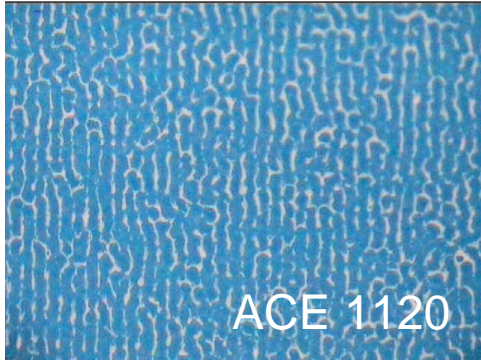


Solid Ink Density (Cushion Tape)

- The highest SID was delivered by 3M1820; the lowest by 3M1120.
- Although SID with 3M1020 is less than 3M1820 there are other benefits from 3M1020 in terms of lower dot gain.

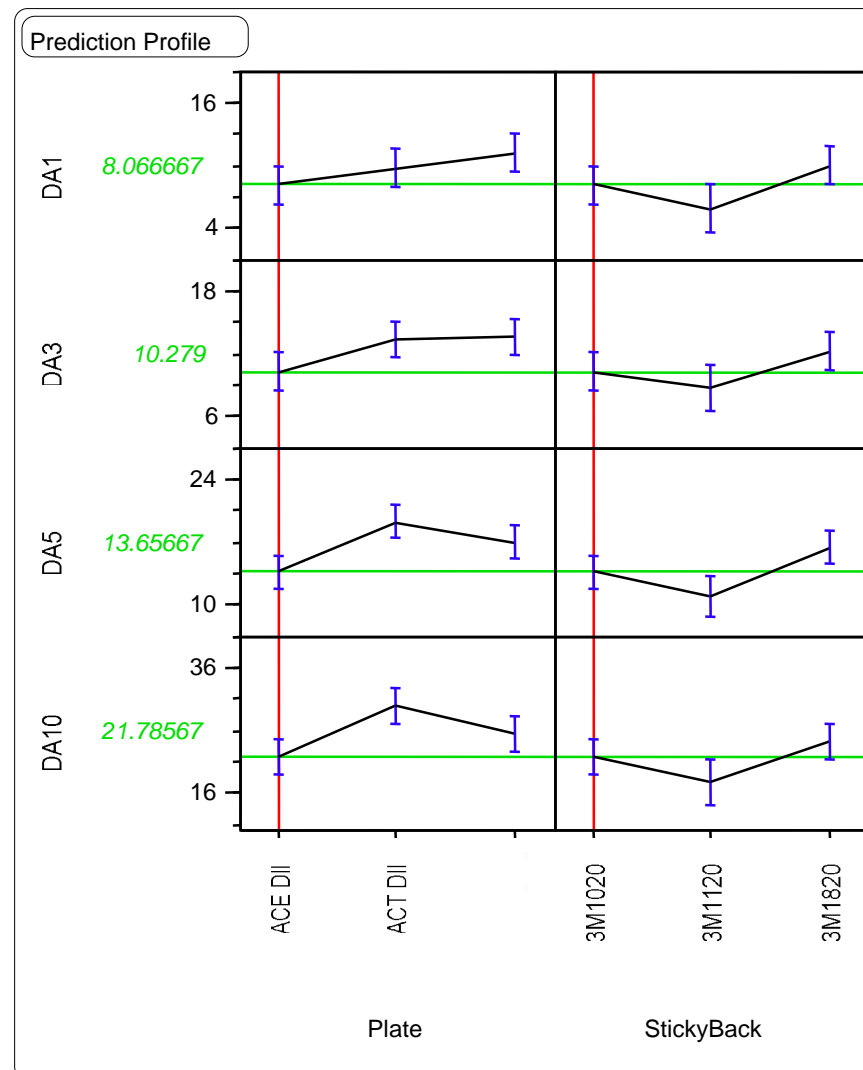


Solids

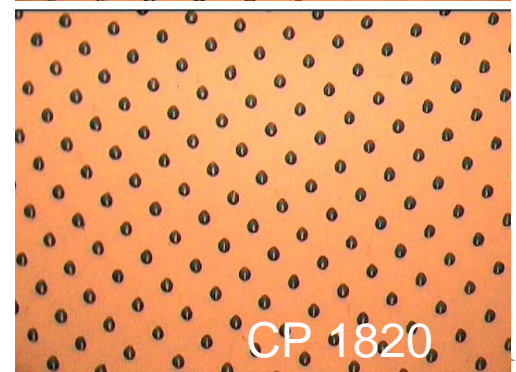
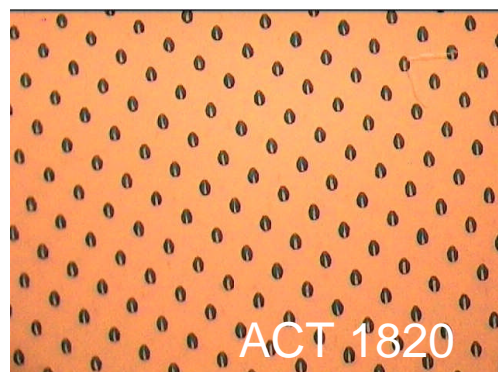
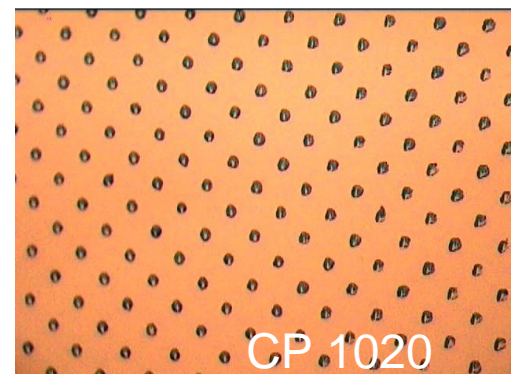
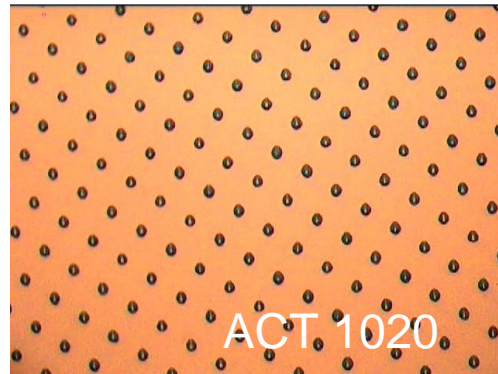
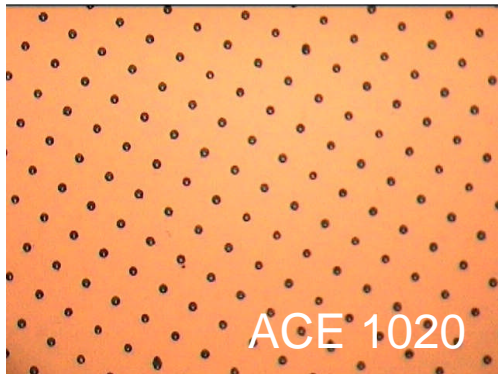
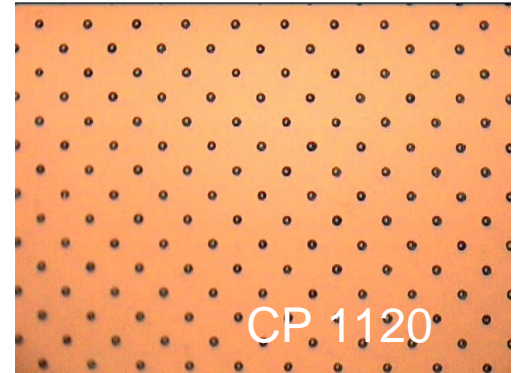
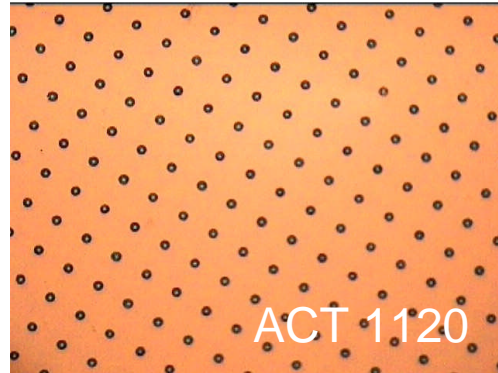
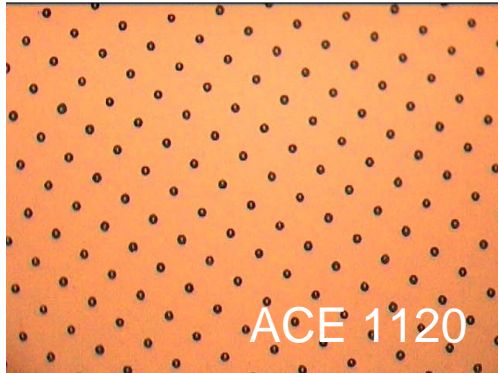


Highlight Dot Area

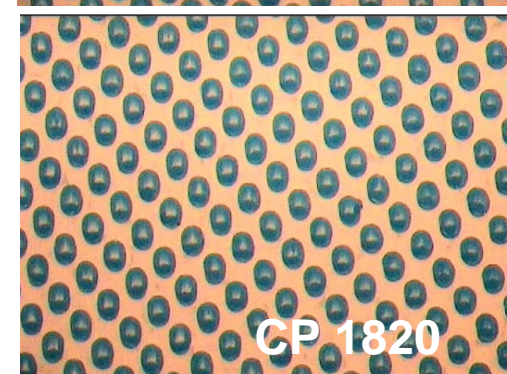
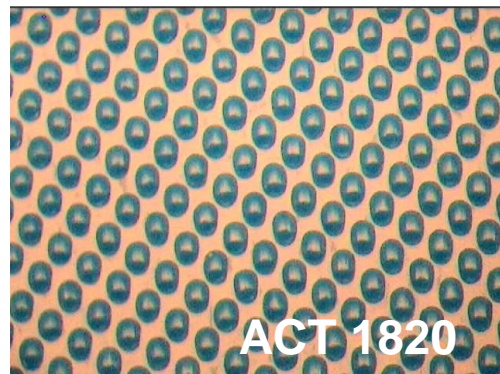
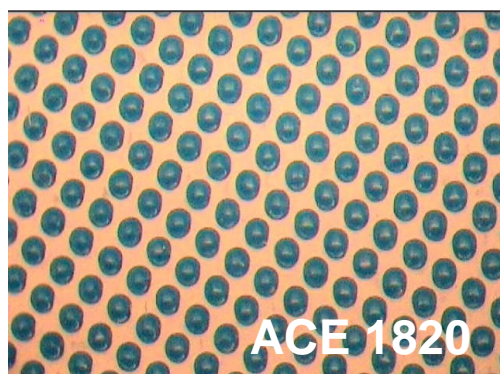
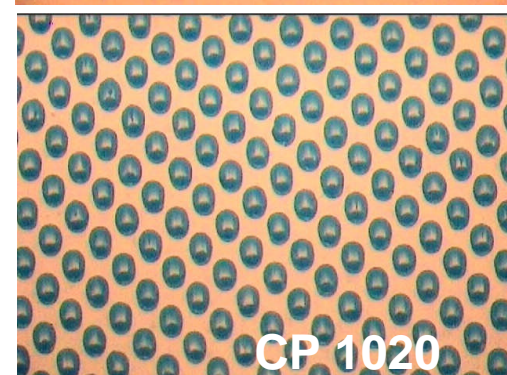
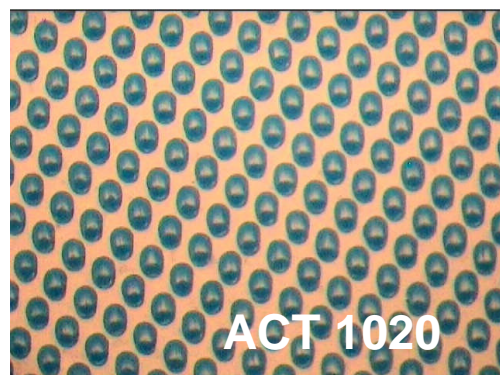
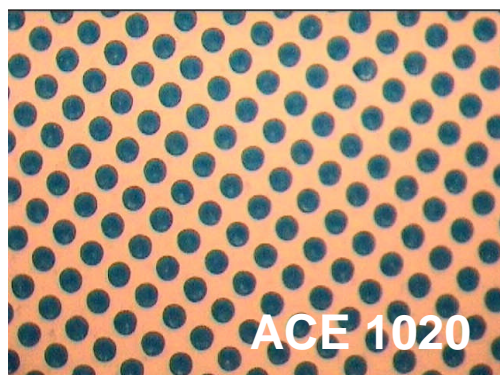
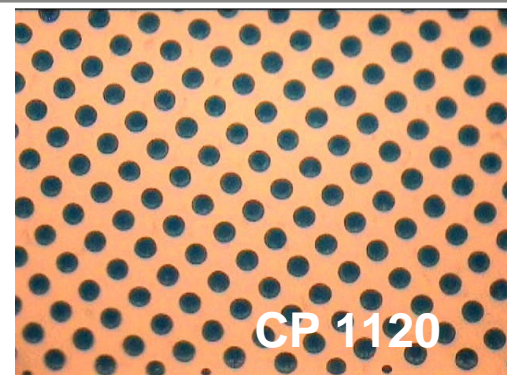
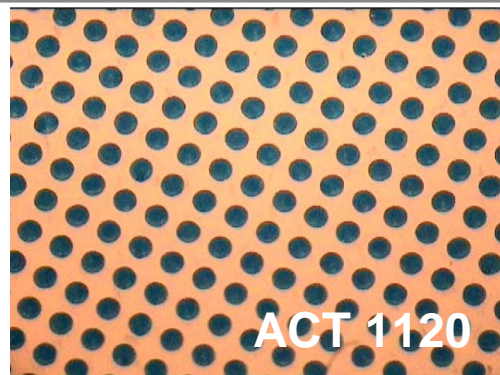
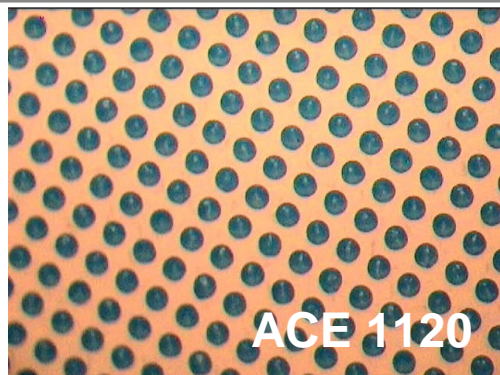
- Plate type influenced printed dot gain. The ACE DII printed with the lowest highlight gain.



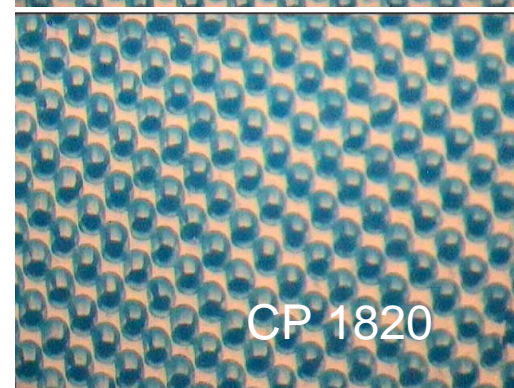
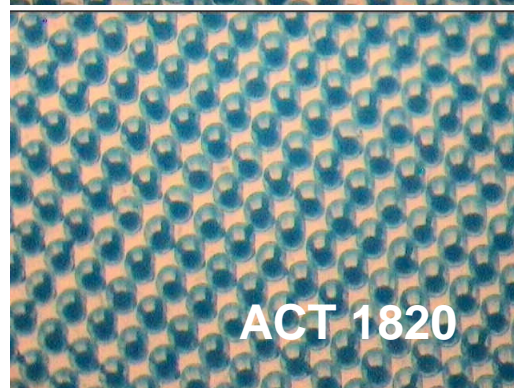
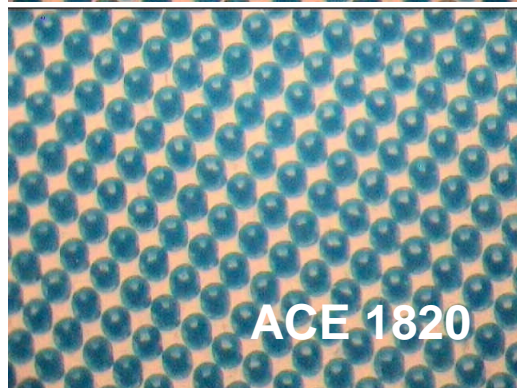
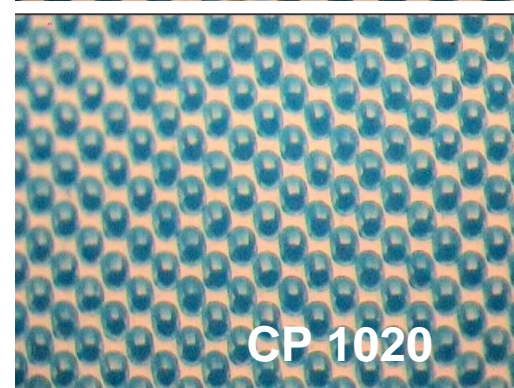
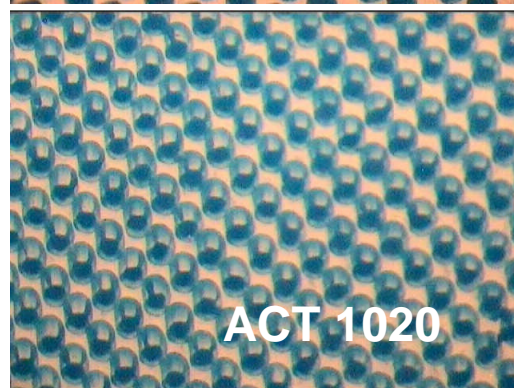
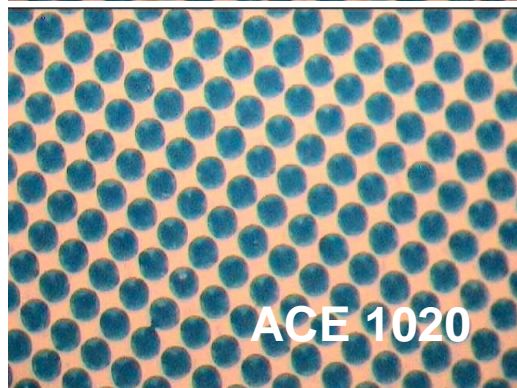
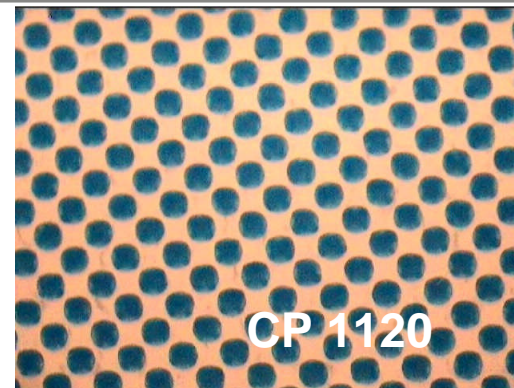
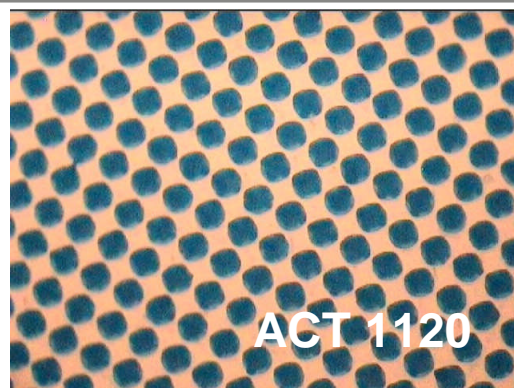
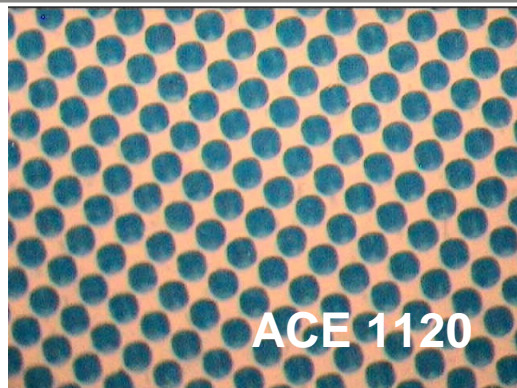
1% 120 lpi



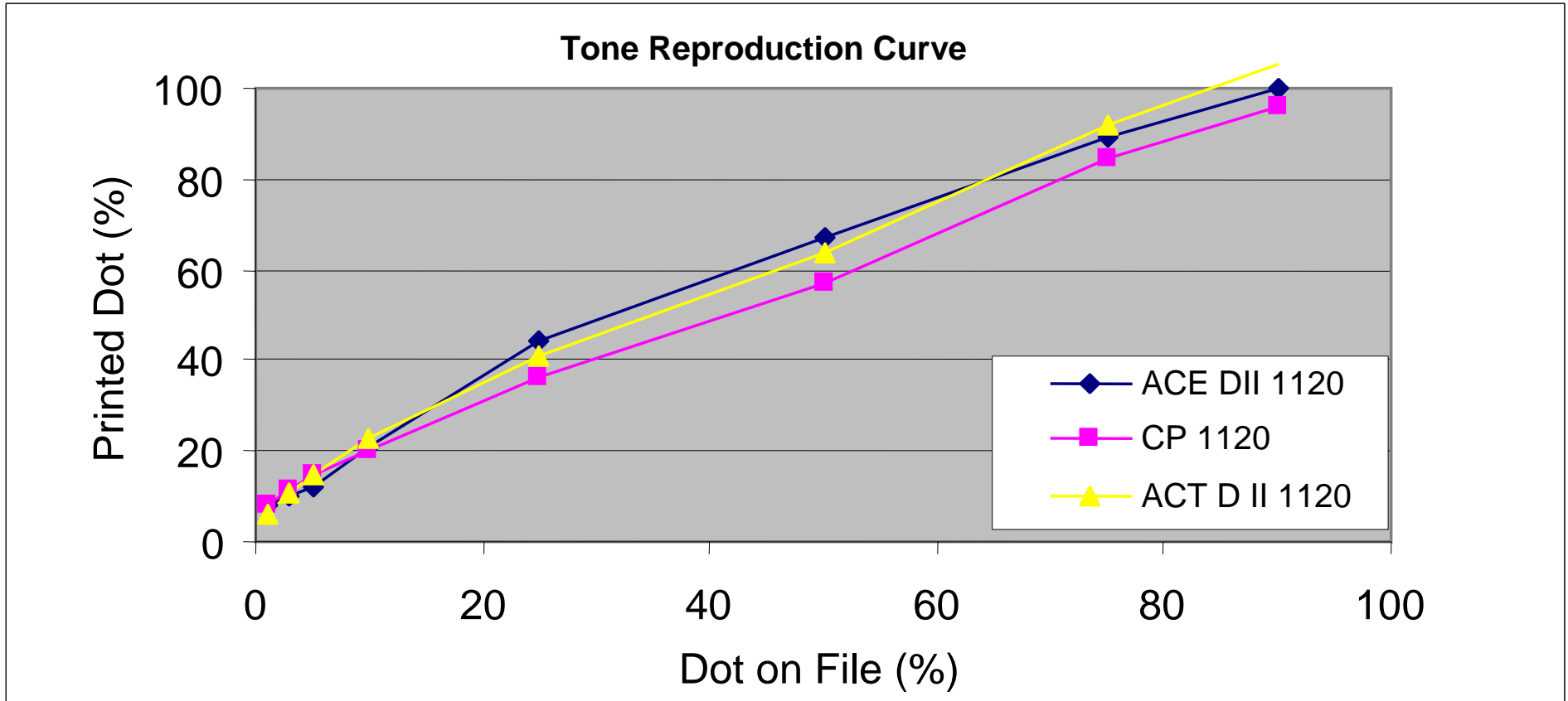
25% 120 lpi



50% 120 lpi



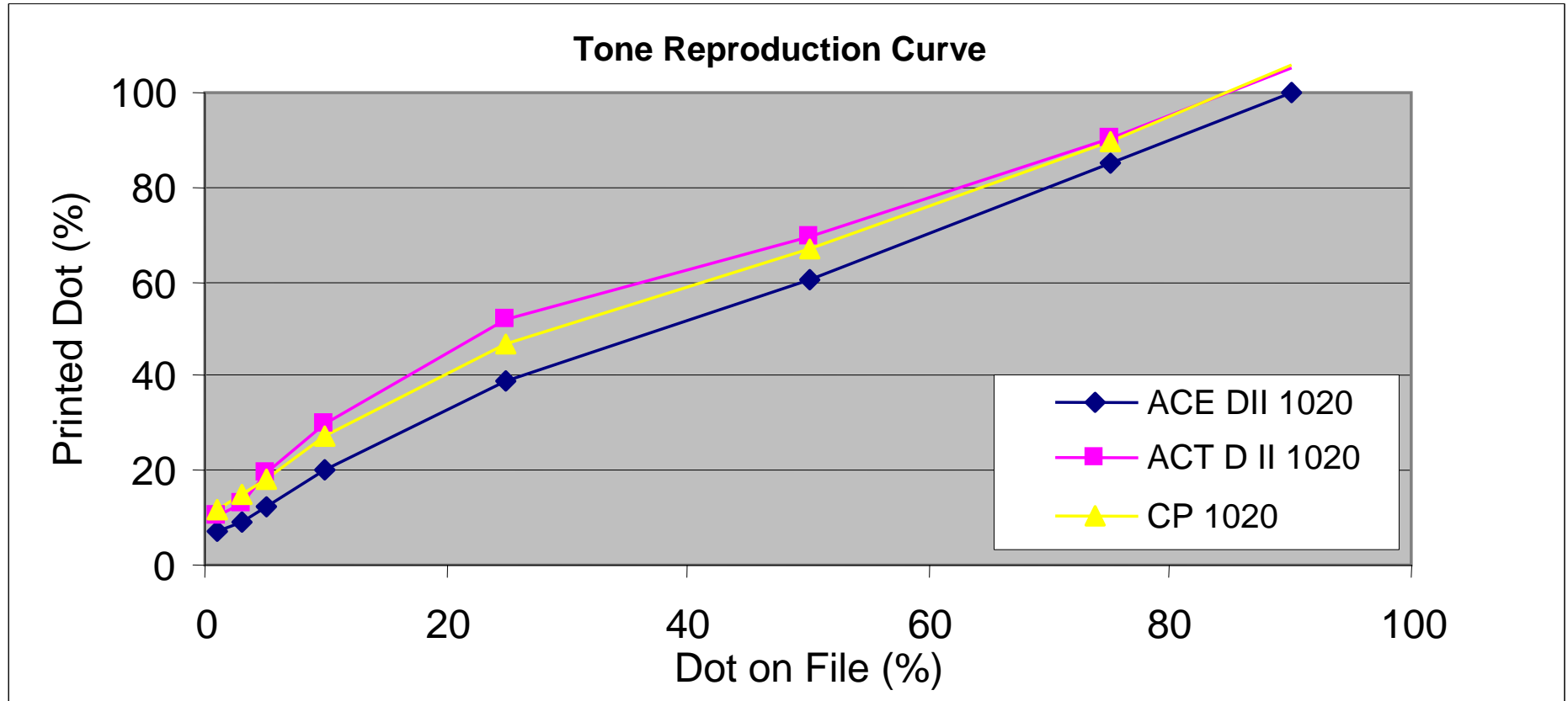
Dot Area 3M 1120



	ACE DII	ACT DII	Competitive Plate
1120	<u>1.28</u>	<u>1.27</u>	<u>1.28</u>
1020	1.66	1.58	1.57
1820	1.87	1.60	1.77

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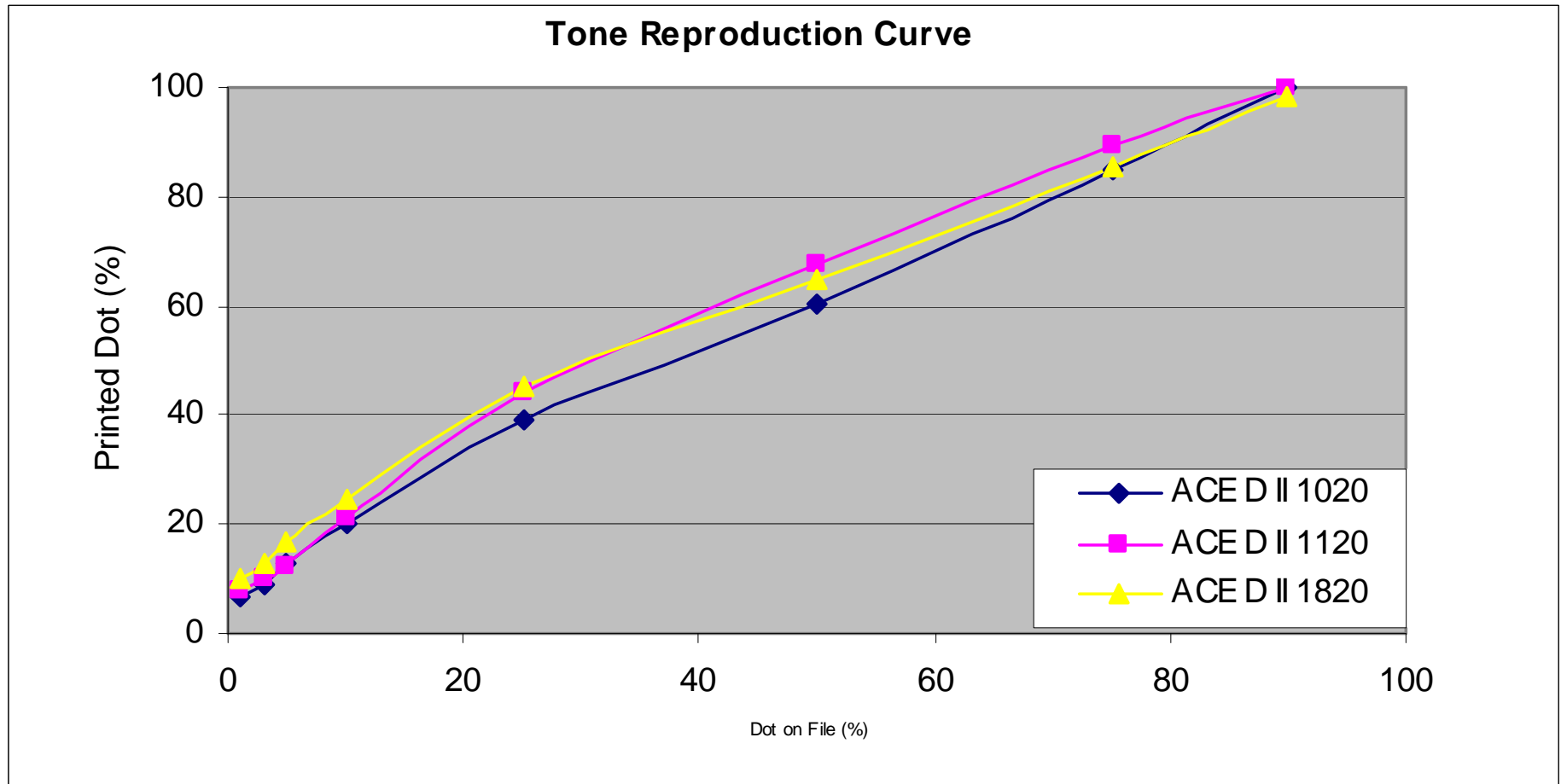
Dot Area 3M 1020



	ACE DII	ACT DII	Competitive Plate
1120	1.28	1.27	1.28
1020	<u>1.66</u>	<u>1.58</u>	<u>1.57</u>
1820	1.87	1.60	1.77

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ACE DII All Stickybacks



	ACE DII	ACT DII	Competitive Plate
1120	<u>1.28</u>	1.27	1.28
1020	<u>1.66</u>	1.58	1.57
1820	<u>1.87</u>	1.60	1.77



Conclusions

- ACE DII printed with the lowest highlight gain and the best overall test results were obtained with the combination of ACE DII plates with the 3M1020 cushion tape.
- Increasing cushion tape modulus increased SID and in most cases dot area on all plate types. However, this was not the case when using ACE DII.
- The highest SID was delivered by 3M1820; the lowest by 3M1120.
- Although 3M1820 delivered the highest SID were tradeoffs in terms of higher dot gain.
- The low modulus 3M1120 cushion tape printed with the highest level of pinholing. Solid coverage was considered unacceptable.

Past DOE's

- Plate Construction
- Effect of face exposure on dot gain
- CO₂ versus YAG engraved anilox rolls
- Tone optimization
- Smooth ink lay down

Trade Shop Benefit

- You will provide efficiency in translating customer requirements into reality.
- That leads to customer satisfaction and trust in your service and performance.
- Saves time and costs



Planning for a DOE

- There is no substitute for careful planning before conducting any sort of experiment.
- The first goal is to have a clear understanding of the objective of the experiment.
- Use your own experience in selecting the best variables and levels to explore.
- A designed experiment provides the most efficient way to decipher that final short list.



Thank You

Rich Emmerling

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