Microscopic analysis of color toner gloss and a comparison of optical gloss level

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Abstract

Laser printer monochrome black print quality has been popular "Glossless". So, there was focused on "Glossless" printing in the design toner materials, fusing systems, and toner developer units. Recently, laser full color printing is getting popular in the office. Simultaneously "high gloss" print quality is more desirable than before. The reason could be that people are now printing picture images by laser printer. As with ink jet printers, people like glossy print quality similar to traditional silver halide pictures. In the past, there were many reports about "gloss" image analysis such as; toner materials (wax, resin), fusing system with developing system optimization, gloss measurement method and so on. And it is commonly thought that to improve print quality one needs to increase "gloss" of laser printer printed images. But is it really true? This report will discuss "how important gloss is to print quality". Using microscopic analysis by SEM, combined with traditional gloss measurement methods such as semi gloss 60°, mechanical surface analysis such as Ra, and human impression of print quality. Results will be discussed and summarized including the design of a printing process with a view toward optimization of image gloss.

Introduction

Print quality is the most important factors to choose printers and media for the end users. Recent trend is "high gloss" of the out put. Traditional pictures, such as applies Silver Halide development technology, is always "high gloss" image. People are used to see pictures with "high gloss".

Recent Digital on demand out put technology has made to print full color pictures like traditional silver halide pictures. This report we will discuss the one of the print quality factor, "Gloss" and what is the important to give the "Good" impression of pictures by laser printer technology. This report is focusing on toner related print quality.

Discussion

The first, this report uses Print quality value as ;

Print quality = 1/Color matching (dE) x Gloss

x 1/Print surface roughness (Ra) (1)

The Color matching and Gloss are dimension less. The print surface roughness calculated by scanned length. The parameters are used in Table 1. And simulated data used in Table 2.

Table 1 : Print quality parameter

1. Color matching	Cyan, Magenta, Yellow, Red, Green, Blue value. Measured by Color spectrometer.
2. Gloss	Cyan, Magenta, Yellow, Red, Green, Blue value. Measured by Gloss meter.
3. Roughness	Using Ra method by Roughness meter.

The first, Color matching effect. The dE is smaller is Print quality value is higher means better quality.

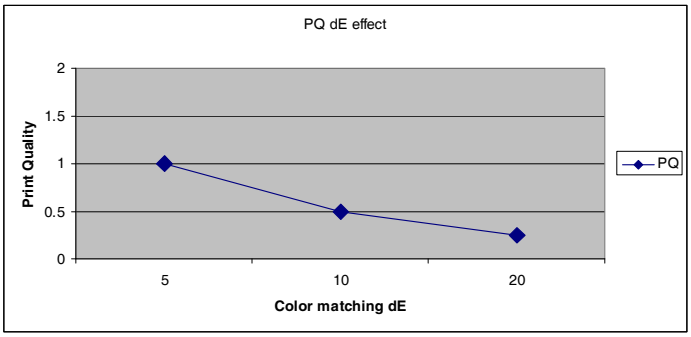

Figure 1. Color matching dE effect to Print quality

The second, Gloss is effect higher Print quality value. To measure Gloss uses semi gloss 60°

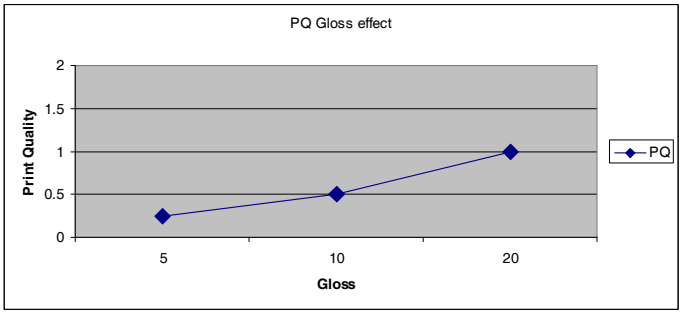

Figure 2. Gloss effect to Print quality

The third, Roughness effect is smaller is Print quality value is higher.

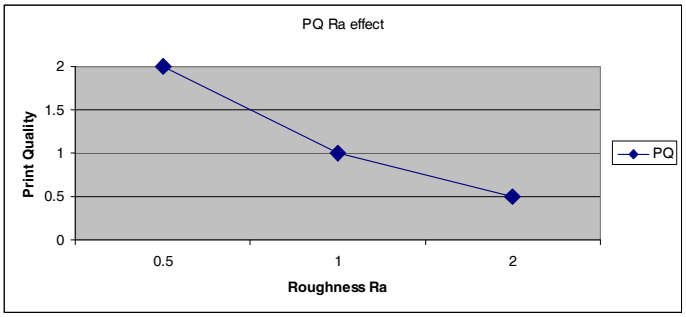

Figure 3. Roughness effect to Print quality

Table 2 : Used parameters for calculations.

dE Effect

PQ	dE	Gloss	Ra (scan 0.8mm)
1	5	10	2
0.5	10	10	2
0.25	20	10	2

Gloss Effect

PQ	dE	Gloss	Ra (scan 0.8mm)
0.25	10	5	2
0.5	10	10	2
1	10	20	2

Ra effect

PQ	dE	Gloss	Ra (scan 0.8mm)
2	10	10	0.5
1	10	10	1
0.5	10	10	2

This Print quality calculation looks like can be explained print quality comparison. And Gloss is the important factor to improve Print quality. The well-known Gloss measurement is shown in Figure 4.

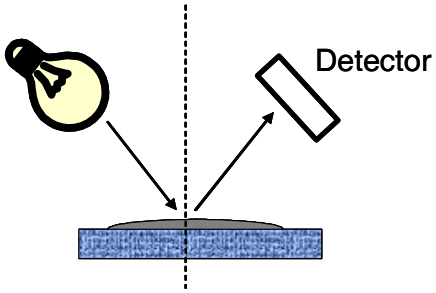

Figure 4. Gloss measurement

Gloss measurement can be higher readings by just surface condition because of roughness effect results. It's shown Figure 5 to explain how to make higher Gloss readings. Even the rougher media, Fusing system can make smooth surface. This can be high Gloss readings, too.

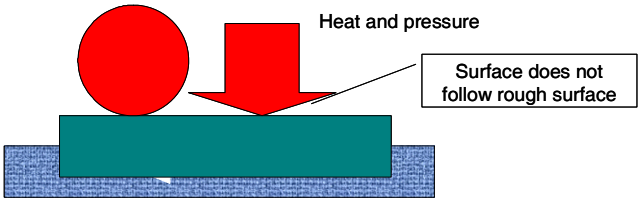

Figure 5. Gloss can be made by process

So, here is the example of SEM picture. The picture is the example of Solid image and paper surface are shown in Figure 6.

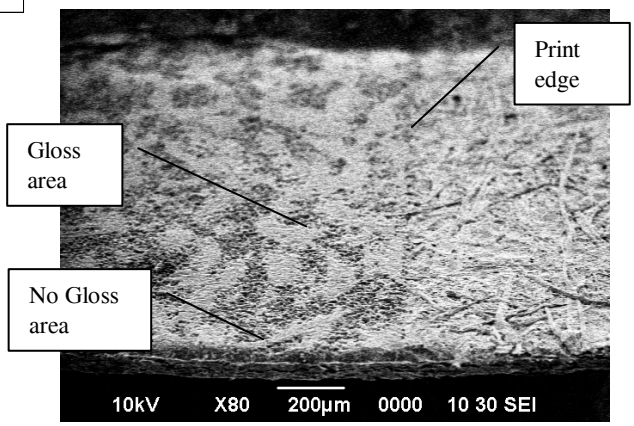

Figure 6. Solid printed area and paper surface

This Solid printed area is "Semi Gloss" by eyes. Microscopic wise there are mixed both smooth surface (= gloss) and rough surface. I will add microscopic analysis data, that is SEM analysis data during conference. And the milestone is to discuss "Good" image quality needs how much gloss for Laser printer prints to discuss within conference.

References

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[2] Y. Kitano (JIS&T, Springfield, VA, 2008) pg. 52(1) : 010504
[3] P. Sirvio (JIS&T, Springfield, VA, 2008) pg. 52(1) : 010505

Author Biography

Tadahiro Kaneko received his BS in physics from the Ibaraki University (1990) and his MS in physics from Ibaraki University (1992). Since then he has worked in the Research and design of laser printer products. His work has focused on the development of toner design and manufacturing issues. Also he is interested in print quality of toner design related. He is a member of IS&T.