

# Research on the Printability of Coated Paper on High-Fidelity Digital Printing

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## Abstract

*The impact of coated paper printability for image quality on the high-fidelity digital printing was studied in this paper. Compared with the traditional printing technology, high-fidelity digital printing technology is more likely to expand the color gamut, maintain the original tone linear and produce vivid image. The performance of coated paper to a large extent determines the image quality. In order to get high-quality printed matters, the mechanism of the coated paper printability influencing on the performance on high-fidelity digital printing is need to be researched in-depth. The printability of coated paper was studied from several aspects in this paper, including the structural properties, roughness, optical properties, absorption etc, the relationships between these properties and printing color, dot reproduction performance were also studied. Based on the previous theoretical and practical studies, the printability evaluation system of coated paper on high-fidelity digital printing was established initially. On digital printing, accurate color management technology also affects the printing quality as the performance of coated paper, so the advanced color management technology was also used in the current study. The results showed that the pore structure and the absorbent of coated paper were the most important factors for affecting the printing quality, and the roughness and optical properties of coated paper also had a certain impact.*

## Introduction

Due to its limitations on papers, ink and production techniques, the conventional color printing using four colors of ink as green, yellow, black, product (C, M, Y, K) makes the color reproduction range greatly reduce[1]. Thus, the conventional printing fails to be applied to high quality image reproduction. Dated back to 1990s, the HIFI printing technology has overcome these defects by adopting a four-color separation printing which expands the reproduction range of color ,responses the nature color more naturally and truly, and makes the chromatic halftoning hierarchical well maintained[2]. It is safe to say that the hifi printing technology has steered another new round of printing work and been the touchstone for the quality printing[3].

As the main carrier of printing, the quality of paper affects that of printed products directly. And the quality of paper performance is finally reflected by the printability of paper. Printability of paper means that the paper can meet the requirements of ink, printing and printing conditions, ensure the printing job, and obtain the conditions which excellent printings must fulfill. So how to evaluate the performance of the printing paper correctly and scientifically is the key of testing the quality of printing products. Based on digital printing, the high fidelity digital printing uses high fidelity color replication technology, in order to reflect the color more truly and satisfy the requirements of

desired printing quality[4]. There are many factors influencing the quality of printing. In the actual production, printing machinery, printing ink and the quality of paper has a core effect on printing quality. The process of digital printing is more streamlined so it is often used in printing operation with strong flexibility. Also, the use of special ink has higher requirements on paper quality. Therefore, its effects on paper printability are very necessary[5].

The aim of this study is establishing a evaluation system on the basis of previous studies by comparing the printability and printing quality of different types of paper[6]. So as to make an objective evaluation on the printability of paper .With the help of this evaluation system, we can select the most matching paper for digital printing in the actual production, based on the characters of printing products and printing process conditions. Thus, we can achieve the purpose of reproducing colors stably and accurately, and we can also make the printing more vivid and accurate.

## Experimental research and analysis

### Performance testing of paper

Here are the paper we use in this experiment,1#-FT190g imitation copper paper,2# - Europe RC180g standard printing paper,3#-Easy Color waterproof semi-bright surface coated proofing paper,4# - RC190high light photographic paper,5- Photograde Semi-Gloss Paper # color Rita,6# - Semi-Gloss Proofing Paper.

In this experiment, we use the paper thickness measuring instrument and electronic weight measuring instrument to measure the thickness and quantitative of paper, and then calculate the density of paper, finally get the porosity of paper. When using the thickness instrument, each sample measures 5 times and then calculate the average thickness. The cutting area of each sample is 100cm<sup>2</sup>. We measure its weight by the electronic weight measuring instrument, and then get its quantity.

Table 1: The quality, density and porosity of paper

Pattern	Average thickness ( $\mu\text{m}$ )	Quality ( g )	Quality ( $\text{g}/\text{cm}^2$ )	Paper density ( $\text{g}/\text{cm}^3$ )	Porosity $\varepsilon(\%)$
1#	201.88	1.9460	0.01946	0.964	37.81
2#	215.53	2.1715	0.02175	1.005	35.00
3#	184.76	1.7051	0.01705	0.918	40.46
4#	212.60	1.8314	0.01831	0.859	44.12
5#	202.92	1.8898	0.01890	0.931	39.92
6#	176.48	1.4987	0.01499	0.840	45.21

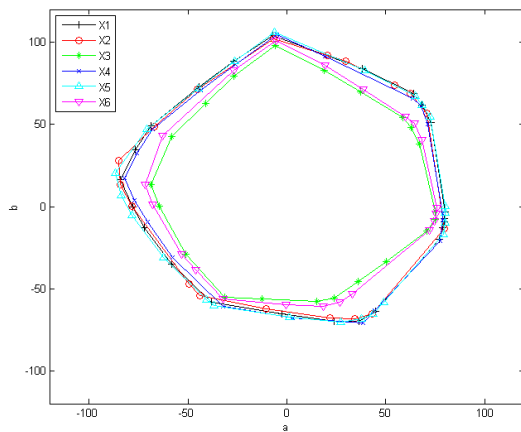
**Table 2: paper whiteness, brightness, opacity and color**

	Whiteness	Brightness	Opacity	L	a	b
1#	118.465	99.04	98.31	95	-0.3	-6.4
2#	88.585	92.62	92.75	97	-0.5	1.1
3#	110.04	93.12	93.49	93	-0.1	-5.5
4#	153.61	106.46	99.67	93	3.2	-15
5#	145.5	108.81	92.27	96	1.62	-12
6#	114.04	93.51	98.28	93	0.99	-6.4

### Printing quality examination

Using a linear Epson Stylo Pro7880C inkjet printer, we printed the same design in six kinds of paper which selected before .And the use of advanced measuring equipments and software makes us obtain the color gamut, solid density, and dot gain and dot fidelity value.

The experimental results and analysis are as follows:

**Figure 1. Gamut graph paper**

As the figure 1 shows, the six kinds of paper have uniform regular polygon color gamut, and there is no obvious color deficiency, in other word, there isn't absence. We can range the six kinds of paper according to the color gamut confine. The result is: 3#, 6#, 4#, 2#, 1#, 5#.

### The effect that properties of paper has on printing color

The following table lists the correlation coefficient between paper performance difference and color difference. We can know that the porosity difference has the biggest impact on color difference. The correlation coefficient of them is 0.9637 and followed it is the brightness of paper which is 0.3609.

**Table 3: Some paper performances**

Performance	Porosity	Roughness	Brightness	Cobb value
Correlation coefficient	0.9637	0.0001	0.0402	0.0423

## Conclusions and analysis

In this experiment ,we study the influence that properties of paper has on printing quality and we estimate it from the following aspects ,such as paper pore structure, surface roughness, optical properties ,absorption properties and so on. Based on the study of the relevance between properties of paper difference and color difference, we draws the conclusion that the pores of the paper structure have the biggest impact on paper color reproduction capability, and paper brightness also has obvious correlation with color gamut range.

## Prospect

From the analysis we can know that it is not easy to establish a link between the printability of paper and the printing quality. This is because the paper contains a number of properties of complex systems. Understanding the paper properties on the quality of printing products effects by comparing different properties of the paper simplify is not perfect. Although this article considers the paper surface microstructure, optical properties, surface contact within the paper and the droplet , the absorbency of paper, trying to present the relationship between the printability of paper and the printing quality as comprehensive as possible , under the limitation of the experimental conditions and time , it still exists some shortcomings. In order to make the evaluation system of the high fidelity digital printing paper printability more perfect, future researchers can try to keep other properties of the paper under a condition of constant change, separate changing a performance of paper, and evaluate how the changes affect the presswork quality, so that such a single variable or main variable experiment can get more realistic evaluation results.

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