

Influences of Cell Angles on Ink Transferring in Gravure

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Abstract: Eight color cells of different area were engraved in gravure plate roller by electronic engraving machine. In the same plate, we used cell angles of 30°, 45° and 60° to engrave images. Then the sheets were got through gravure proofer. Measure the densities of color cells by densitometer, weigh the ink transferred to paper, and analyze the influences of cell angles on ink transferring. It is studied that impact of different angles on tones copying is great. In the same engraving conditions, the transferred ink quantity is the largest with 45°, while it is the lest with 60° .

Keywords: gravure; cell angles; density of printing; transferred ink quantity

1. Introduction

Gravure printing is the most important one of the four major printing, and is widely used in packaging printing and specialty printing industries. As gravure products are rich and colorful, it has been loved by the people. In printing process, the quality of products is mostly decided by the transferring of ink. But to gravure, the 70% is decided by making plate, the other 30% is printing [1].

In the field of gravure plate-making, electronic engraving is the most important way. For the change of open area and depth of cell, it is much more complicated for ink to transfer in gravure printing. In the color reproduction, to avoid moiré and reduce the volatility of color, it is necessary to set different screen lines for each separation plate. As cells are engraved only once, during engraving plate, the angles of cell can only be changed by its shape, which is achieved by stretching and squeezing to the opening of cell [2].

Cell angle is the angle between the line through the nearest two cell centers and the longest line through level cell. And it is determined by the ratio of the horizontal and vertical lines.

In gravure printing, the diamond dot is always adopted. The cell's angles with equal edges are 45°, while the angles with squash cell are less than 45°, and the angles with enlongtated cells are larger than 45°. In practice, cell angle varies from 30° to 60° [2]. Normally, 30°, 45° and 60° are adopted. As the cell angles are different, it leads the structure different. That may have impact on ink's transferring, which is the thesis content.

2. Experimental section

2.1. Experimental Methods

According to gravure making and printing process requirements, the original and the gravure printing plate are produced including dot coverage rate of 5%, 10%, 20%, 40%, 60%, 80%, 90% and 100% respectively.

Secondly, using 70LPC screen ruling and 120° engraving

needle angle, by varying cell angle plate making parameters (respectively 30° cell angle, 45° cell angle, 60° cell angle), the same plate cylinder is engraved in order to maintain the same printing conditions.

Finally, the samples are obtained by gravure printing proofer. From the sample, the amount of ink transfer to the paper and the values of density of different dot area rate are measured to investigate influence of cell angle on ink transfer.

2.2. Experimental conditions

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The materials are follows: Kim Dong 128 g/m² coated paper, DIC gravure solvent magenta ink, a viscosity of 23s (3# Zhans Cup). The printing pressure, doctor blade pressure and printing speed are 800 kg, 300 kg and 10 m/min, respectively.

2.3. Experimental equipment

The gravure is engraved by electronic engraving machine (M-850, OHIO,USA) . The sample are printed by gravure proofer (SC2600*1500,J.M.Heaford, England) and the values of the density are measured by spectrophotometer (SpectroEye ,X-rite,USA) .

3. Results and discuss

3.1. The effect of screen ruling on the transfer of ink

The same manuscript, under the screen ruling 70LPC and

engraving needle tip angle 120° conditions, gravure plate including cell angle plate making parameters 30° , 45° , 60° were engraved, then the samples are obtained by printing proofs, and the transfer amount of ink from the plate to paper using precision electronic balance. The values of density of different dot area rate of sample are measured using spectrophotometer. The relationship between the amount of ink transfer and cell angle is shown in figure 1, and relationship between cell angle and density is shown in figure 2.

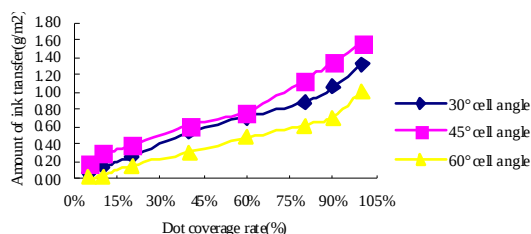


Fig.1 The relationship between cell angle and the amount of ink transfer

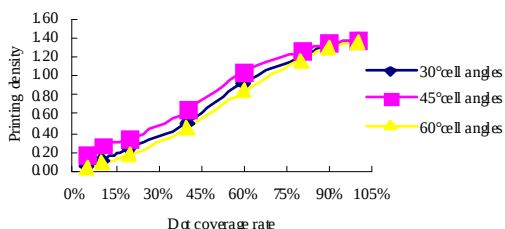


Fig. 2 Relationship of cell angle and printing density

It is shown in figure 1 that the amount of ink transfer differentiate from the cell angles in the same condition of graphic, ink, and paper. From the result, we know that the amount of ink transfer is the largest when the cell angle is 45° , and the amount is the least when 60° , while the amount is the middle when 30° .

In the same condition of lines and caved pin's angle, the hole openings of the horizontal and vertical direction are approaching, thus the opening area is relatively large and the cell is relatively deep. The results show that the transferred ink quantity is high in the printing process. For the 30° of cell angle, the horizontal width of the cell opening is big and the vertical direction is small. For the 45° , the horizontal direction of the cell opening is small and the depth is shallow. For the 60° , the horizontal width is small and the vertical direction of cell opening is big. So the cell area and the depth is almost same with the 30° . The result is that the transferred ink quantity of 30° and 60° is smaller than that of 45° . The transferred ink quantity of 30° is higher than that of 60° , which explains that the structure of large width of horizontal direction is conducive to transfer ink.

In gravure, because of the cell structure of the 60° ,

cells of shadow tones are not connective, but the 30° and 45° communicate well. So in shadow, the transferred ink of 30° and 45° is much larger than that of 60° .

From the amount of ink transfer, a different cell angle makes the changing point of ink transferred amount different. The inflection point of 30° lies in the cell of 70% dot area, and the point of 45° lies in that of 60% dot area while that of 60° in 80% dot area.

From figure 2, under the same conditions of printing, ink and paper, the relationship between cell angle and printing density is consistent with the relationship of cell angle and ink transferred quantity. That means the ink transferred quantity is larger and the density is bigger. However, the transferred ink growth reducing, the density changes little. It is mainly because the thickness of ink is heavy (up to ten microns) no matter what the cell angle is. The density always maintains same. Totally, the density of 45° angle is the biggest, which reflects a good effect. The density of 30° and 60° is close.

From figure 2, no matter what angle is adopted to the structure, the density increase roughly from 40% of the dot area. It is up to that the dot of diamond shape is used in gravure.

4. Conclusion

Through studying on the transferred ink impact by the cell angle in gravure, the conclusions are following:

- The vary curve of ink transfer is different for different screening ruling and the amount ink transfer doesn't always increase with screening ruling increasing (more cells in unit area), but it is better with more ink transfer amount. The value of ink transfer doesn't always increase with screening ruling decreasing and cell deeper. There is a best screen ruling to be selected.
- Different screen ruling, in high light and middle tone area, the ink transfer isn't better with screen ruling more bigger or smaller. But in the darkened part, amount of ink transfer decreases with the screen ruling increasing, so it is better for ink transfer.
- Cells of different angles make the inflection point position different. The changing point of 30° is 70% of dot area, that of 45° is 60%, and that of 60° is 80%.
- For any angle of the cell structure, density of 40% of the dot area began rising rapidly.

5. Acknowledgment

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