

The Characteristics of Ghost Mechanism in a Non-Magnetic Single Component Process Depends on a Diameter of the Toner Particle

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Abstract

A non-magnetic single-component process is produced and reported for basic development characteristics.

For example, the characteristics of development mechanism using an elastic development roller depend on the resistance of a development roller[1-3], the mechanism of the thin toner layer formation with a doctor blade[4-6], the toner sticking phenomena on the doctor blade[7] and the ghost formation mechanism for the surface potential of the development roller with high resistance[8].

The uniformity of development ability for half tone image is a significant subject in a contact single-component non-magnetic development system. And we found the ghost formation is explained by the difference of the toner diameter on the surface of the development roller before the development to the photoconductor.

Introduction

Non-magnetic single-component development system has simple structure and is advanced in these past 10 years at Small Office and Home Office (SOHO) market.

With application expansion of statement above, examination is done about the fundamental development characteristic.

As for the examination to establish it as high quality print technology of the thing that the elucidation of fundamental mechanism of non-magnetic single-component development system. It was not enough to progress. Ability of uniformity of half tone image is an important subject with non-magnetic single-component development system.

The mass of the development depends on the toner diameter, and it happens to ghost phenomenon with a half tone, and toner diameter difference of the toner layer on the development roller is examined.

Finally, we confirmed what we could explain it with the fundamental equation[1,2] of development.

Experimental

Fig. 1 showed an abstract of an experimental unit. As for the development unit, developing roller, toner supply roller, toner regulation member (a blade) and discharged sheet are each established in the case, and each V_R, V_{TAR}, V_{BL}, the bias voltage of V_{DSC} are supplied.

A development roller is using the single layer conductive rubber, which added with carbon particles in a base with polyurethane rubber. A toner supply roller is conductive elastic sponge roller dispersed carbon particles.

A toner is supplied to the development roller from supply roller by bias voltage difference $V_R - V_{TAR}$ of development roller and toner supply roller.

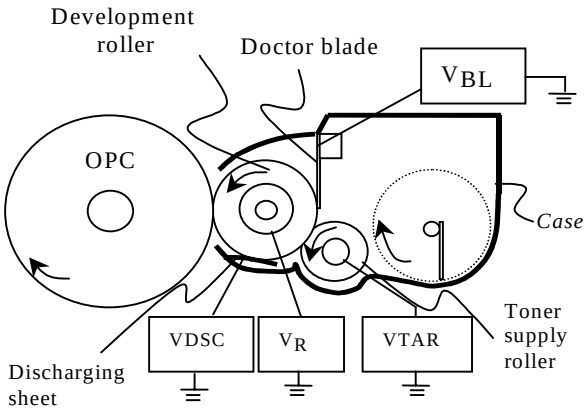

Figure 1. Schematic diagram of the experimental apparatus

A toner is supplied development roller with is conveyed in doctor blade by rotating of development roller and it is fixed in thickens of toner layer of wish by metal blade thickness 0.1 mm and charged.

After the development process, toner which remained behind in development roller top is collected in the development unit, and it pass through discharged area, and a process of the beginning is repeated.

In discharged area, discharge the toner charges by the bias voltage difference $V_R - V_{DSC}$ of development roller supplied by conductive resin seat-of discharging seat-electrical resistance 10^5ohm and do collection to depend easily to strip off mechanical for the toner supply roller.

It is shown specification of an experimental device used for Table.1 by examination of this time.

It is equivalent to about around 30 ppm print speed.

Table.1 Specification of the Experimental Unit

Parts	Specification	
Photoconductor	Material Diameter	OPC 65mm
Development roller	Diameter Hardness Resistance Surface roughness Dielectric constant Elastic layer thickness Bias voltage	32mm 60degree(JIS-A) 10^6 ohm 1s(Rz) 10 8mm V_R-250 volts
Toner supply roller	Diameter Hardness(sponge) Resistance Sponge layer thickness Cell density Contact depth Bias voltage	20mm 68 degree 10^5ohm 5mm 80 cell/inch 0.5mm-1.0mm V_{TAR} -450 volts
Doctor blade	Material Thickness Blade length Pressure Bias voltage	SUS304 0.1mm 18mm 30gf/cm V_{BL} -350 volts
Discharging sheet	Thickness Resistance Bias voltage	0.2mm 10^5. V_{DSC} -150 volts
Process speed	Photoconductor	185 mm/sec
	Development roller	275 mm/sec
	Toner supply roller	215 mm/sec

Result

Basic Development Characteristic

About the develop toner to the photoconductor depend on an electrical resistance of the development roller ,it mentioned above to be done some report [1-3] already.

In this examination, influence of development roller resistance did not seem to go and turned development roller resistance into a parameter and examined electrical resistance of development roller and relation of mass of development toner.

In a simulation, relationship between the development potential and the mass of development begins to be saturated from $10^{6.5}$ohm neighborhood and can ignore a difference in 10^6ohm and 10^5ohm (see Fig. 2).

Effect of Contact Depth of Toner Supply Roller

Fig. 3a and 3b showed white area and toner diameter of the next process of solid area at having changed contact depth of toner supply roller.

The density difference of half tone more than 2.5E-6 m (difference of the toner diameter) contact depth at the time of 0.5 mm solid area and a difference of white area was 0.04~0.07 with delta I.D.

A difference of toner diameter supplied understands that it become a few differences to 1E-6 m, and the density difference with a half tone becomes delta I.D=0.01 or less with it, and a ghost is canceled when turn contact depth into 1 mm.

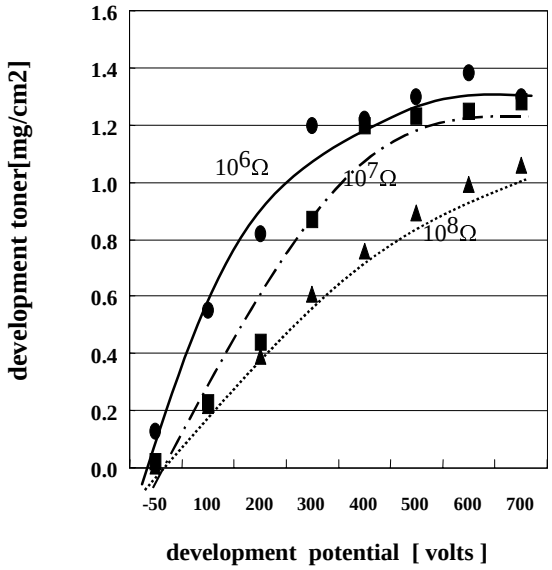

Figure 2. Mass of the development toner (mg/cm^2)

Discussion

When toner which was not used when developed by a latent image on the photoconductor is collected by the development unit and receives toner supply of the next process with toner supply roller, did not development toner remains behind on development surface, and the reason why toner diameter of the toner layer on development roller changes into for the correspondence to image pattern equivalent to white area or solid area of an image is so that it is used in the development of the next process with rotating of development roller.

This is toner supply area, and adhesive force to development roller is strong, and a little particle size toner can remove from the surface of the development roller about a thing of large particle size relatively when easy to be exfoliated.

In particular, in the solid area (development area) and white area, a difference is easy to appear by all consumption and all faults consumption, and half tone development does detect of non-uniformity easily furthermore.

That the force that adhesive force of toner is overcome, and remove toner is necessary expected in order contact depth of toner supply sponge roller puddles toner particle of development roller surface in mechanical, and to drop it. Even if charge of unit area of toner is uniform, a quantity of charging with electricity of unit weight becomes high as particle size is small, and the mass of toner which moves to photoconductor with the equal development potential difference decreases.

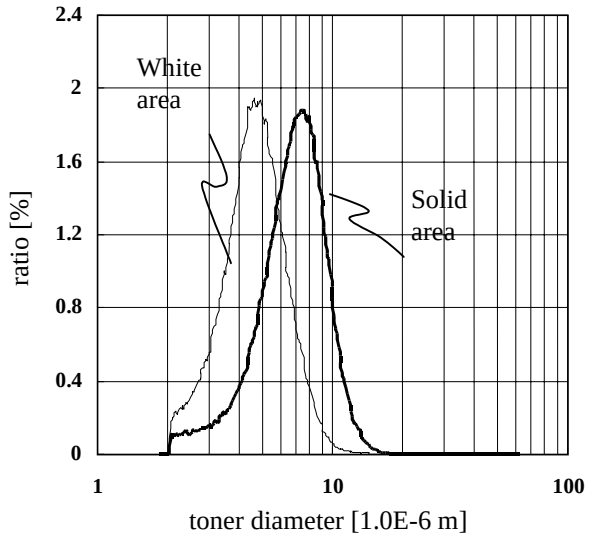

Figure 3a. Compared with Solid area and White area for the ratio of the toner diameter after development-contact depth 0.5mm.

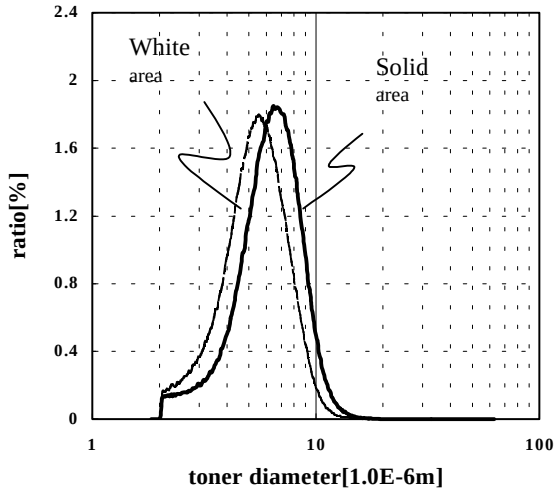

Figure 3b. Compared with Solid area and White area for the ratio of the toner diameter after development-contact depth 1.0 mm.

When it became mass of development difference or the transfer paper density if a history of the former process was left at development roller toner stratum with that purpose, and we watched an image, it is thought when it become the ghost of the former development process and appear.

Conclusion

1. By fixing with toner diameter development roller toner layer formed aloft in non-magnetic single-component development system that used conductive elasticity develop-men roller of a ghost, there was not it, and was able to get a print of high image quality.
2. It get possible to keep toner diameter on a development roller uniformly by turning discharging parts of did not develop toner and contact depth to development roller of toner supply roller into around 1 mm.
3. A method it is torn off, and to promote a final performance of toner on the development roller discharge of toner charge using an electric method is effective.

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Biography

Toshihiko Takaya received his B.S. in Physics from Science University of Tokyo in 1984 and M.S. in Electrical Device Engineering from The University of Electro-Communications in 1994. From 1984, He engages in research and development of electrophotgraphic process engineering .

He engages in research and development of electrophotgraphic process in Sharp Corporation from 1995, and current interest is simulation of electrophotgraphic process engineering.

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