Improvement of Contact Work Efficiency by New Film Technologies

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Abstract.
For greater productivity in the photomechanical process, we have developed new technologies which provide better dimensional stability, durable antistatic capability and shorter drawdown time. Dimensional stability is improved by a water barrier layer which stands against film expansion during processing. Static charge decay is enhanced by an electroconductive layer. Finally, a shorter drawdown time is achieved through a new matte technology.
These new technologies which are built in the new series of Fuji contact films will be described.

1. Introduction

As demand for color printing grows, the technical complexity of pre-press work has been increasing. The film making staffs work under tight schedules and strict deadlines because of the desire by customers for faster turnaround time and precision printing. The color separation scanner for tone-reproduction brought an epoch-making innovation into the photomechanical process in respect to quality, productivity and cost savings. Contact films which can be handled in a bright room and hybrid rapid access systems such as Fuji Grandex System, Ultratec System have also improved productivity. On the other hand, retouch exemplified by dot etching and assembly processes which need skilled craftsmen are the most labor intensive. Therefore the labor saving aspect and improved working conditions in these processes are two of the most important points for overall productivity. In contact works there are still some problems for operational efficiency such as film remakes due to fit problems, and dust and dirt deposits by static. For greater productivity, continued improvements in operational efficiency have been required.

The dimesional changes of graphic arts films have been studied by J. M. Calhoun[1], P. Z. Adelstein[2] and A. Murakami et al.[3),4)] DuPont X' STAT contact films which retain antistatic capability before and after processing were first antistatic films developed. Last year we announced a new series of contact films which provide better dimensional stability, durable antistatic capability and faster vacuum drawdown time.

In this paper we describe new technologies which are incorporated in the Fuji contact films VU-100/LU-100 of "FINELITE HG (High Grade) series" and also discuss our studies on dimensional changes.

2. Features of New Technologies

The improvement of operational efficiency in contact work has been achieved by the following three new technologies.

1. Water barrier layer which is provided on the PET base inhibits the water absorption resulting in better dimensional stability.
2. New antistatic layer comprising electroconductive material dispersed in gelatin provides durable antistatic capability, which brings release from static diposition of dust and dirt.
3. New matte surface layer reduces drawdown time in printer work.

The layer structure of "HG series VU-100" is illustrated in Fig. 1.

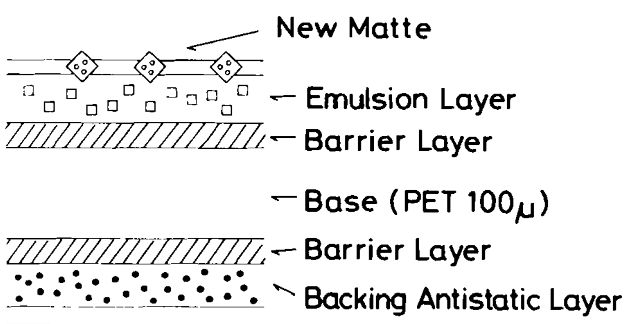

Figure 1. Structure of HG Film

3. Dimensional change in automtic processing

We were often faced with fit problems of film expansion at low humidities. To analyze the film behavior, experiments on size changes in automatic processing were conducted as follows.

(Experimental)

Model film: An emulsion layer ($AgCl$, 0.2 μm, Ag, 3.8 g/m², thickness 4.0 μm) and a protective layer (thickness 1.0 μm) were simultaneously coated on a polyester base (100 μm) with a gelatin layer (thickness 3.5 μm) on the back.

Processing conditions: Fuji Graphic Processor FG-660F, GR-D1 Developer 38℃ 20″, GR-F1 Fixer 36℃ 16″, Wash 25℃ 16″, Dryer temperature 50℃.

The dimensional changes in automatic processing were traced under the following conditions.

1. The model films (5cm×20cm) were conditioned to 50% RH at 25℃ for at least 4hrs and film dimensions were measured by pingauge method[5].
2. The films were then conditioned to 30%RH at 25℃ for at least 2hrs. After which, the film dimensions were remeasured.
3. And then the model films were processed in an automatic processor. The film dimensions were measured at the end of the water wash and also after drying.

The effect of dryer temperature on dimensional changes were also analysed by the above method.

Separately, the dimensional change of polyester (PET) base itself by water absorption and release was measured as follows.

1. The PET film base (5×20cm) was conditioned to 30% RH at 25℃ for at least 2hrs.
2. Then the base was bathed in water and was measured during bathing by the same pingauge method.
3. After bathing, the base was subjected to measurement again at 25 ℃ and 30%RH.

(Results and discussion)

The dimensional changes in automatic processing to ambient humidity conditions of 30%RH are plotted in Fig. 2. Curve-a shows the dimensional behavior of film which is exposed and processed at an ambient humidity of 30%RH after being conditioned to 50%RH at point O. The film contracts between point O and P due to lowering humidity. After printer exposure (point P), the film is processed in the automatic processor. At the end of water wash (point W), the film is in its wettest condition and thereby greatly expands. At three minutes after the drying (point A3), all the expansion brought about by water wash is not eliminated to cause dimension problems. It should be noted that, even after 120 mimutes coditioning under the ambient humidity (point A120), the film does not restore to its original size. Curve-b represents the behavior of the PET base itself. These curves show that the expansion and contraction of the base as well as those of the gelatin have great effect on the behavior of the film. It is now evident that the fit problem encountered at low humidities has two main causes; one is slow contraction after drying and the other the unrestored expansion. The former is due to the delayed water release of the PET base as shown in Fig. 3 and the latter is due to the dimensional hysteresis which is related to the drying conditions.[1)~4)] In order to reduce the dimensional change of the film, the processor dryer temperature should be adjusted to such as to avoid overdrying particularly at low humidities. (Fig. 4)

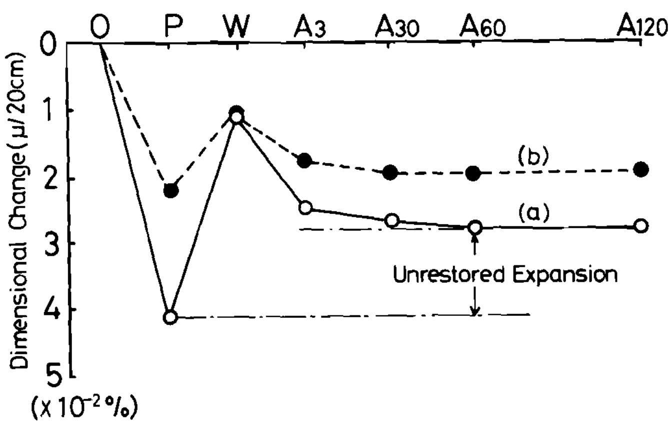

Figure 2. Dimensional Changes of Film (a) and PET Base (b) in Automatic Processing

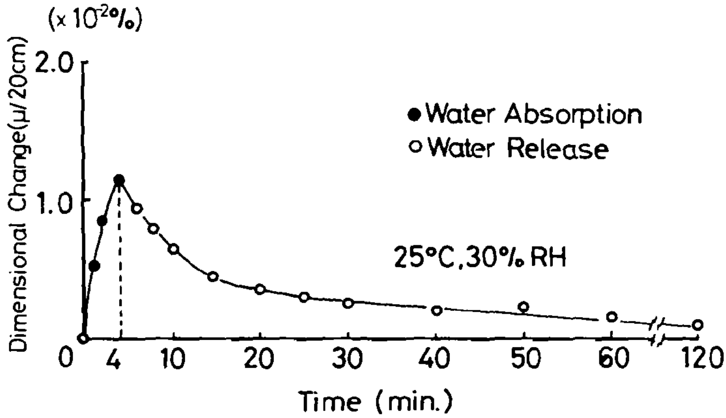

Figure 3. Dimensional Changes of PET Base by Water Absorption and Release

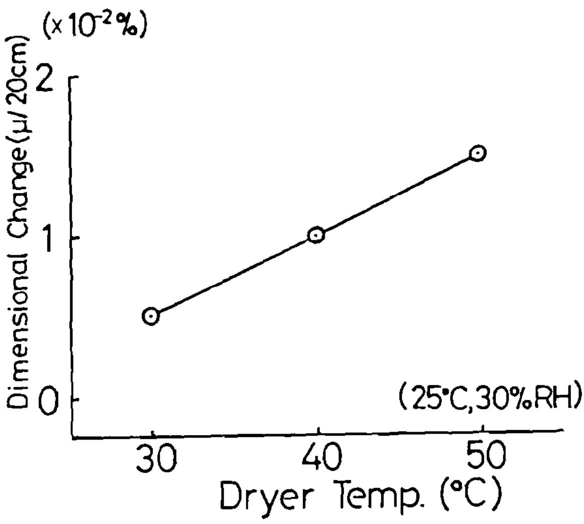

Figure 4. Effects of Dryer Temperature on Dimensional Changes

4. Characteristics of "HG series VU-100" and Improved Efficiency in Contact Work

4-1. Dimensional stability

As the experimental results show, the dimensional stability of graphic arts films is greatly affected by environmental temperature and humidity changes and developing conditions. The water barrier layer incorporated into PET base is resistant to water absorption during processing as shown in Fig. 5. This layer, therefore, stands against film expansion. Size changes in HG film during automatic processing with ambient conditions of 25℃ and 30%RH are shown in Fig. 6 in comparison to conventional film. The expansion of HG film caused by the water wash (point W) is much less than that of conventional film resulting in a less dimensional change. (point P→point A3) An improvement in fit problems achieved by HG film is demonstrated for the spread and choke procedure in Fig. 7. HG film shows a more even outline than that of conventional film.

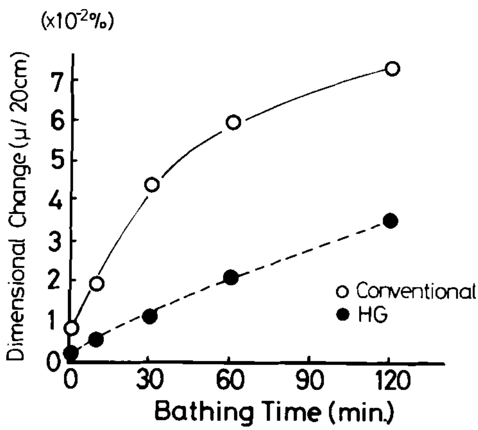

Figure 5. Water Barrier Capabilities of Conventional and HG Film Bases

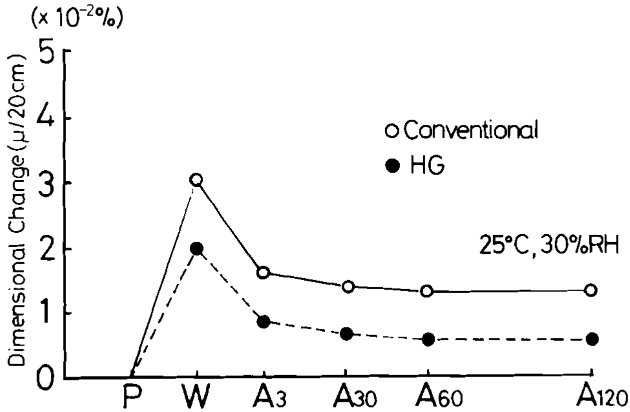

Figure 6. Comparison between Conventional and HG Films for Dimensional Change

4－2. Antistatic capability

Opaquing in photomechanical and printing processes is mainly due to the deposit of dust and dirt which is related to the static. Further, accumulated electrostatic charges tend to discharge, not only giving an unpleasant shock to the operater but damaging electronic circuits of equipment. HG film has also considered a counterplan to these problems; the electoconductive layer on the back keeps a sufficiently low surface resistivity before and after processing (Fig. 8), reducing pinholes and thus the needs of opaquing.

4－3. Vacuum drawdown time

Reducing vacuum drawdown time in printer work is also important for further enhancement of productivity. The new matting agent which is incorporated in HG film gives a sufficient level of surface roughness with a fewer number of particles as shown in Fig. 9. This agent, therefore, provides improved air release during vacuum drawdown and avoidance of density uneveness such as Newton ring with no significant increase in haze and pinholes. The drawdown time of HG film is about half in comparison to conventional film.

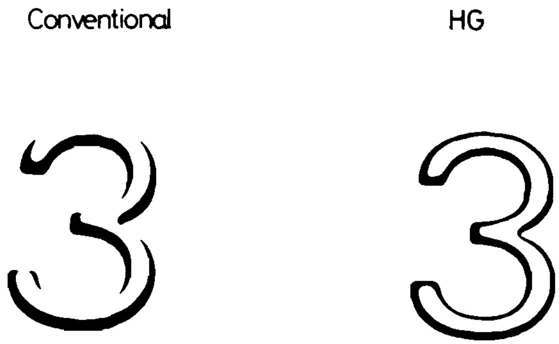

Figure 7. Example of Fit Problems for Spread and Choke Procedure

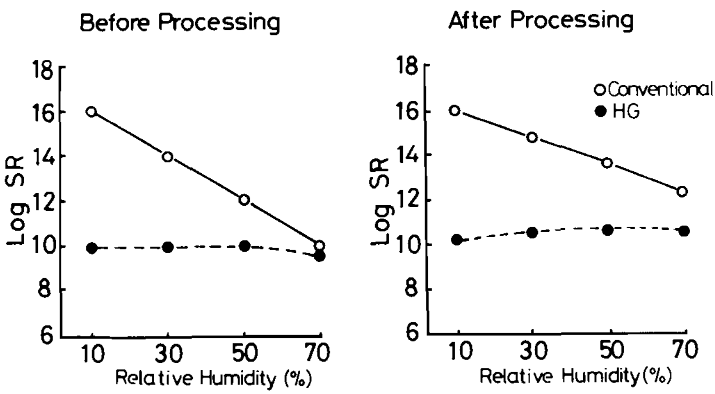

Figure 8. Comparison between Conventional and HG Films for Antistatic Capability

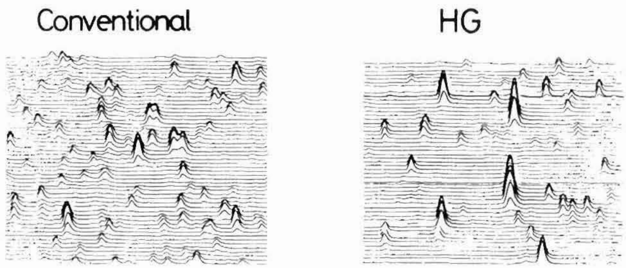

Figure 9. Three Dimensional Surface Roughness of Conventional and HG Fi l,ms

5. Conclusion

We have developed new technologies which provide better dimensional stability, durable antistatic capability and faster drawdown time. These technologies incorporated in the Fuji contact films, called "HG series" are accomplished by the water barrier layer, the electroconductive layer and a new matting agent.

These technologies will be able to contribute to the greater productivity in the photomechanical and printing processes.

Reference

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