Effect of Drawing Parameters on the evenness of C/P Blended Yarns

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1. INTRODUCTION

The evenness of slivers and rovings is greatly important for the improvement of quality in final yarns[1]. In order to produce even yarns, all fibers would have to be uniformly distributed over the whole yarns. However, that is ruled out by the fiber inhomogeneity and by the mechanical constraint. Accordingly, there are limits to obtain the evennes of fiber assembly. Also, since the evenness of yarn has greatly influenced on the evenness of slivers in drawing process, the optimum condition of drawing process is very important[2~4].

In drawing process, doubling and passage conditions are generally used to improve the evenness of slivers. By doubling, the variations along the length of individual slivers are partially averaged out. By drafting, the fiber alignment is improved and the strand is brought back to form suitable for further processing[5~8].

In this paper, we have investigated the effect of drawing parameters on the evenness of C/P blended yarns. We have calculated theoretical evenness of C/P blended yarns and established the optimum condition of drawing process, such as doubling strand, number of passage and blending conditions.

2. THEORETICAL CONSIDERATION

The limiting irregularity of blended yarns can be determined by considering fiber length, fineness and fiber extent. In this study, since the cotton fibers are not perfectly straight in the C/P blended yarns, the limiting irregularities were calculated with consideration of fiber extent in cotton by the equation (1).

$$CV_{h-\lim} = \frac{100}{\sqrt{nh}}\sqrt{1+0.0004(CV_d^2+CV_h^2)} \quad (1)$$

Where, h is fiber extent of cotton, CV_d is coefficient of variation of cotton diameter(%) and CV_h is coefficient of variation of cotton fiber extent(%). While, the limiting irregularities of blended yarns were calculated by using the yarn size corresponding the percentage of particular fiber component in blended yarns. The limiting irregularity of blended yarns was calculated by the equation (2).

$$T_K = \frac{T_G \cdot P_K}{100} \quad (2)$$

Where, T_K is yarn size for each particular fiber component(tex), T_G is linear density of the blended yarns, P_K is percentage of the fiber components to the overall yarn and K is index of particular fiber components. Finally, the limiting irregularity of blended yarns was calculated according to the equation (3).

$$CV_{\lim} = \frac{\sqrt{\sum_{n=1}^{k}(CV_{n\,\lim} \cdot T_n)^2}}{T_G} \quad (3)$$

Where, $CV_{n\,\lim}$ is limiting irregularity of each component to the overall yarns(%)

3. EXPERIMENTAL

For this study, we have prepared rovings by 100% cotton carded sliver(30mm, 4.0micronaire) and 100% polyester carded sliver(38mm, 1.25d) in order to produce C/P blended yarns. In addition, 3% black polyester was used as tracer fibers to investigate the characteristics of yarns. The C/P blended yarns were manufactured by a pilot spinning machine(SKF spintester). The drawing parameters have included numbers of doubling strand, passage of drawing and blending conditions. Table I shows manufacturing conditions of C/P blended yarns.

The unevenness of C/P blended yarns was measured on a USTER® TESTER 4(Zellweger Uster Ltd.). The diagram range and diagram speed set up ±100% and 100m/min, respectively.

Table I The manufacturing conditions of C/P blended yarns

Feed roving type	C/P blended rovings
Blending ratio	C/P: 100/0(M_1), 75/25(M_2), 50/50(M_3), 25/75(M_4), 0/100(M_5)
Draft condition	Passage number: 1(P_1), 2(P_2), 3(P_3), 4(P_4) Doubling strand: 4(D_1), 6(D_2), 8(D_3)
TM(twist multiplier)	TM 3.5(15.7 TPI)
Back draft	1.5
Total draft	20
Roller gauge(mm)	C/P: 100/0(M_1), 75/25(M_2) : 44×44 50/50(M_3) : 44×47 25/75(M_4), 0/100(M_5) : 44×47
Distance clip	C/P: 100/0(M_1), 75/25(M_2) : red 50/50(M_3) : white 25/75(M_4), 0/100(M_5) : black
Spindle speed(rpm)	8,000
Roller weight	C/P: 100/0(M_1), 75/25(M_2) : red 50/50(M_3) : red 25/75(M_4), 0/100(M_5) : red

4. RESULTS AND DISCUSSION

4.1 Limiting irregularity

Figure 1 shows the effect of doubling strand and number of passage on the limiting irregularity(CV_{lim}) of C/P blended yarns. The limiting irregularity of C/P blended yarns decreased as the doubling strand and number of passage have increased. Because the linear density of C/P blended yarns increased with increasing doubling strand and number of passage. The limiting irregularity of C/P blended yarns has decreased 0.6% with increasing doubling strand and 0.3% with increasing number of passage.

Figure 2 and Figure 3 indicate the effect of doubling strand on limiting irregularity of C/P blended yarns with 2 passage and 4 passage, respectively. It shows the trend that the limiting irregularity of C/P blended yarns has decreased due to the increasing the yarn size of C/P blended yarns with increasing doubling strand.

Figure 4 shows the effect of doubling strand on limiting irregularity of C/P blended slivers and rovings with 2 passage. The limiting irregularity of C/P blended rovings has increased about 1.0% compared with the limiting irregularity of C/P blended slivers with increasing doubling strand. The reason is that C/P blended rovings become fine more further drawing processes.

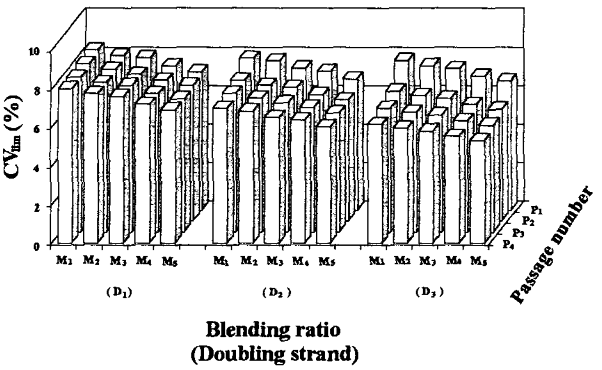

Figure 1. Effect of doubling strand and number of passage on limiting irregularity(CV_{lim}) of C/P blended yarns.

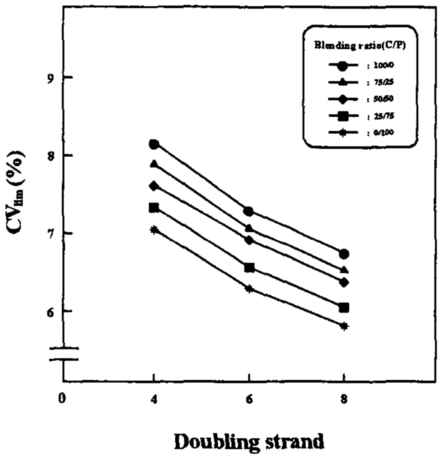

Figure 2. Effect of doubling strand on limiting irregularity of C/P blended yarns.(passage number: 2)

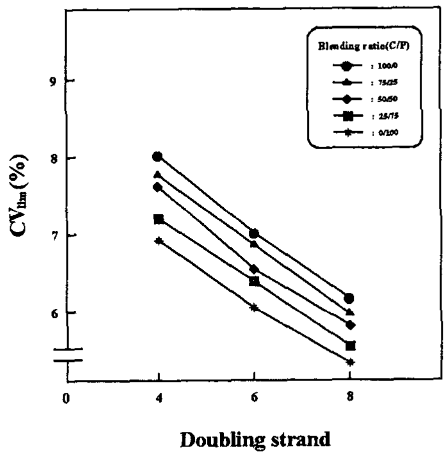

Figure 3. Effect of doubling strand on limiting irregularity of C/P blended yarns.(passage number: 4)

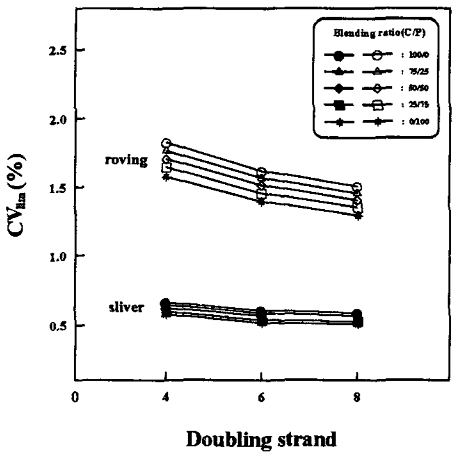

Figure 4. Effect of doubling strand on limiting irregularity of C/P blended slivers and rovings.(passage number: 2)

4.2 Actual irregularity(slivers and rovings)

Figure 5 and Figure 6 shows the effect of doubling strand on the evenness of C/P blended slivers and rovings with 2 passage and 4 passage, respectively. The general trend find out that the evenness of C/P blended slivers and rovings increases as doubling strand is increased, because rovings have more even structure by doubling. The evenness of C/P blended slivers and rovings also increased with increasing number of passage. It is considered that the evenness of

C/P blended slivers and rovings has increased by parallelizing the fibers due to separation of fibers and decreasing the hook and nep formation in the slivers and rovings.

And the evenness of C/P blended rovings has decreased about 3.7% compared with the evenness of C/P blended slivers with increasing doubling strand. The reason is that C/P blended rovings become fine more further drawing processes.

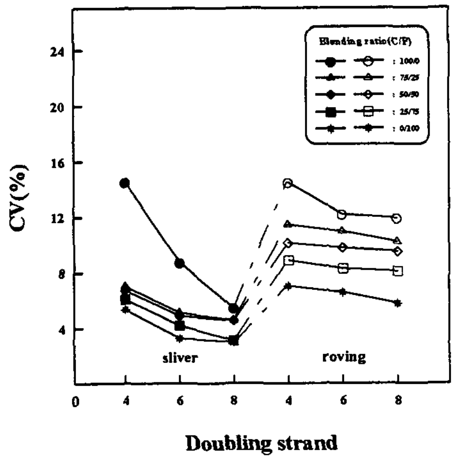

Figure 5. Effect of doubling strand on evenness of C/P blended slivers and rovings. (passage number: 2)

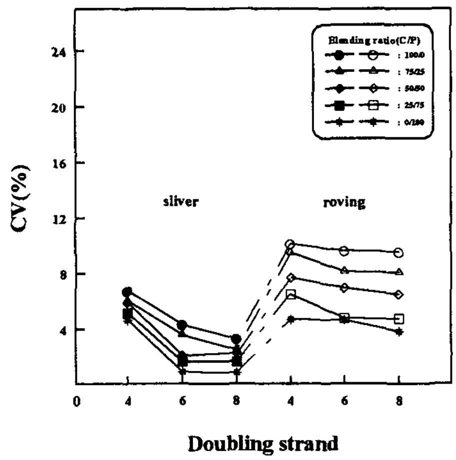

Figure 6. Effect of doubling strand on evenness of C/P blended slivers and rovings. (passage number: 4)

5. CONCLUSION

We have investigated the effect of drawing parameters on the evenness of C/P blended slivers, rovings and yarns. From this study, the following results can be obtained:

1. The limiting irregularity of C/P blended yarns have decreased about 0.6% with increasing doubling strand and 0.3% with increasing number of passage. And also, The limiting irregularity of C/P blended rovings has decreased about 1.0% compared with the evenness of C/P blended slivers with increasing doubling strand.
2. The evennesses of D_2 and D_3 rovings have increased 0.8% and 1.2%, respectively with increasing doubling strand and decreased about 1.7% with increasing number of passage.
3. The evenness of C/P blended rovings has decreased 3.7% compared with the evenness of C/P blended slivers as doubling strands increased.

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