Production of Open-End Hybrid Yarn

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1. INTRODUCTION

Recently the yarn applications are not limited to those traditional ones. Many usage of yarn which were as a dream several years ago, today became indispensable needs; such as use of 3-D fabrics in shuttle space engine. Technology must be ahead of our society development and answer to the new needs and demands. Combination of different materials in new yarns provides special functional advantages, which can be a solution. Hybrid yarns are structures consisting of several component fibers. At present, very few of DREF-3 friction spinning machine are in use. Even though these are probably the only commercial machines for spinning all staple core-wrap yarns suitable for apparel fabrics. Therefore there is a need for an inexpensive method of producing hybrid yarns on common spinning equipment[1].

Open–end rotor spinning has emerged as a successful textile engineering strategy for spinning short staple yarns[2]. In this study we describe progress in producing three kinds of novel hybrid yarns by combination of staple fiber and filament yarn on an experimental open-end rotor-spinning machine. The new process is readily adaptable to open-end rotor-spinning frames with some modifications.

2. MATERIALS AND METHODS

An experimental open-end rotor spinning frame with a filament-feeding device was designed to accommodate the package of filament yarn. A diagram of spinning process is shown in Figure 1. Suitable metallic tube fitted on the center of rotor, enable the filament to be accurately positioned at the center of the rotor. The filament feed tube was mounted on small ball bearing and could be fix when the rotor rotated.

The polyester filament was fed from a supply bobbin, around suitable guides and a tensioning device to the feed rollers of the filament-feeding device. Then passed straight through the feed tube, and was drawn through the rotor and doffing tube, and finally take-up rollers. Back filament tension could be measured with a tension meter positioned between the filament feed rollers and feed tube.

The rotor (67 mm diameter) was run at 30,000 rpm, and the opening roller speed was 7,500 rpm. We used a cotton sliver (2.7 cm mean fiber length and a 3.68 ktex sliver size) and a 150 denier (16.67 tex) colored polyester multi filament yarn. 73 tex hybrid yarns were produced on the experimental open-end rotor-spinning machine.

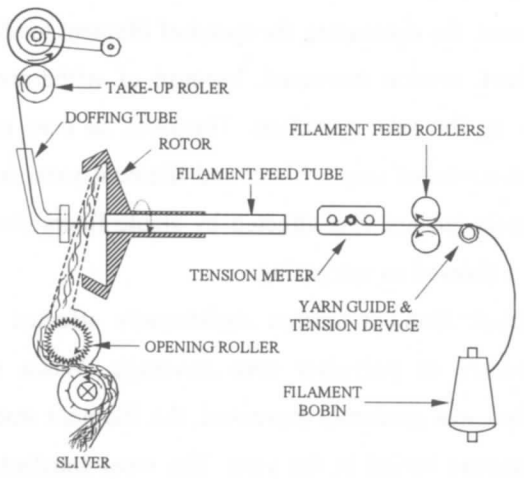

FIGURE 1. Schematic of spinning process

3. RESULTS AND DISCUSSION

By changing filament-feeding speed several hybrid yarns were produced. The yarns were categorized into three groups. Magnified photographs of typical yarn in each group are shown in Figure 2.

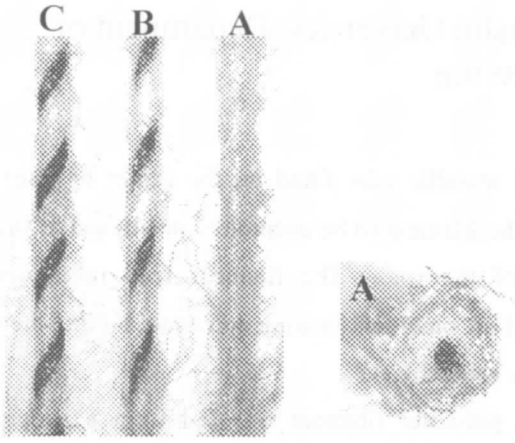

FIGURE 2. Photographs of new produced hybrid yarns. (Left) Longitudinal views. (Right) Cross-section of type A yarn.

In the type A yarns, the polyester core is completely covered by the cotton fibers. But in the type B yarns, polyester filament and the cotton yarn are twisted together and it looks like a twisted yarn. And finally in the type C yarns, the polyester filament yarn covers the cotton fibers.

Figure 3 shows the effect of filament feeding speed on back filament tension. In case of feeding only filament into the rotor, when its speed was equal to take-up speed (37 m/min), there was no tension on filament. By decreasing the speed of filament feeding, its back tension increased, because of withdrawing yarn by the take-up rollers. However, in case of a combination of staple fibers and filament yarn, back filament tension was affected by staple fibers strand and it showed an increasing.

Back filament tension significantly affected the efficiency of polyester core coverage. When this tension was gradually increased, the filament started to become buried in the yarn. The most satisfactory yarn appearance and degree of filament cover were obtained when back filament tension was more than about 50 gf. The filament lied near the center of yarn, such as a core. The yarn appearance of this group (type A) was similar to a 100% open-end spun rotor yarn. We named this group of yarn as rotor spun core yarn. In low level of back filament tension (less than about 10 gf), filament yarn wrapped over staple fibers strand. This kind of yarn (type C) was rotor spun wrapped or covered yarn. With medium level of tension yarn appearance was similar to both A and C types, so we named this group of yarn (type B) as Half & Half hybrid yarn.

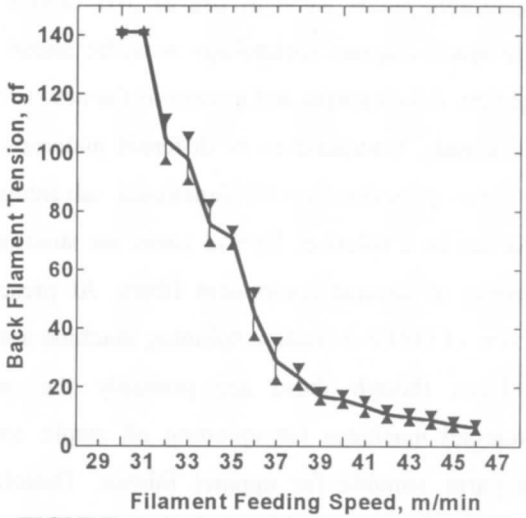

FIGURE 3. Relationship between back filament tension and filament feeding speed

4. CONCLUSION

With this new spinning technology it is possible to produce hybrid yarns on an open-end rotor spinning frame. Changing the back filament tension varied the appearance of the filament in open-end spun hybrid yarn. Finally, our future plan is to produce different type of hybrid yarns on this frame with new other development.

5. REFERENCES

[1] G. L. Louis, H. L Salon. Text. Res. J. , 59, (1989).

[2] Lawrence, C. A., and Chen, K. Z., Rotor spinning Textile Prog. 13 (4), (1985).