Comparison of Hook Extent Distribution of Fibres in Feed Sliver and Rotor Fibre Ring

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The pattern of hook extent distribution in rotor fibre ring has been found to be highly positively skewed having a prominent peak between 2-4 mm. The pattern remains unaffected by the direction of sliver feed and the number of times it has undergone drawing operation.

Keywords: Hook extent, Leading hooks, Rotor fibre ring, Sliver feed, Trailing hooks

Fibre configuration in rotor fibre ring has attracted the attention of many research workers since it affects spinning behaviour besides yarn quality. The performance of opening roller as a separating device and of the rotor as a collecting device can also be assessed from the disposition of fibres in the rotor fibre ring. Many research workers have studied the state of fibres in rotor fibre ring and it has been found that fibres in the rotor ring remain in hooked, looped and entangled configuration. Nield studied the effect of spinning (i.e. fibre separation, collection and twisting operations) on fibre configurations by comparing the fibre shapes in the feed material with that of spun yarn. However, the effect of the pattern of hook extent distribution present in sliver on the pattern of the same in the rotor fibre ring has not been reported and hence the present study.

Viscose rayon fibre (1.5 den, 38 mm) was used in the present study. The tracer fibre technique was used for noting down fibre configuration. Carded, two and four times drawn slivers of 0.56 hank, mixed with 0.5% tracer fibre, were produced on Shirley miniature card and Platt's miniature draw frame. Fibre hook extents were measured and their distribution was plotted on a graph paper.

The slivers (three ends together) containing tracers were fed to Suessen OE spin tester at the rate of 8.03 m/min. The opening roller speed and rotor speed were kept at 108.3 and 750 rps respectively. The machine was run for 8-10 s and then the feed was stopped and the suction was made inoperative. The rotor was then stopped and the deposited fibre ring was carefully removed. The rings were kept in a glass container before being taken to the ultraviolet light source for further observations. The rings were taken out and torn apart using thumb and fore finger. The opened up fibre rings were laid under UV source and viewed using a magnifying glass. The hook extent of those tracers were noted whose entire length was somewhere at the middle of the opened up rings. The tracers present at the edges are likely to be disturbed by the tearing process and were, therefore, excluded. Hook extent distributions were then plotted. Hooks in rotor ring were categorized into leading and trailing hooks. In rotor fibre ring, leading hooks are those whose hook direction matches the direction of rotation of the rotor, otherwise they are trailing hooks.

The results are shown in Figs 1-3. Fig. 1 shows the distribution of hook extent for majority hooks (trail...

Fig. 1—Hook extent distribution of majority and minority hooks present in feed sliver

Fig. 2—Hook extent distribution of leading and trailing hooks present in rotor fibre ring (majority hooks fed as leading).

Fig. 3—Hook extent distribution of leading and trailing hooks present in rotor fibre ring (minority hooks fed as leading).
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Fig. 3—Hook extent distribution of leading and trailing hooks present in rotor fibre ring (majority hooks fed as trailing).

The high speed with which the opening roller teeth act on the fibres cause some of them to buckle at their front ends immediately in the form of a hook around the teeth and subsequently pull them in hooked configuration. If at this stage the fibre is released from the feed nip, it will be carried forward to the stripping point in a hooked state. Dyson observed the presence of many hooked fibres on the surface of the opening roller using high speed photography. In this mode most of the fibres will get hooked at their leading ends and the extent will be such that it is just sufficient to exercise the minimum grip required to withdraw and transport the fibre to the stripping point. It seems that most of the hooks seen in the fibre ring are preferentially generated by the second mode and their extent lies mostly between 2-4 mm.

When the fibre with its leading end hooked is presented to the opening roller, it may break if the hook extent is so large that the loop formed by it is caught by the teeth while both the limbs of the hook remain in the feed nip or the hooked end gets straightened out by the brushing action of the teeth provided the other end is still nipped at the feed. However, for card sliver, the distribution pattern gets completely changed. Therefore, the processes involved from separation to collection generate hooks having extent predominantly between 2-4 mm.

There could be mainly two different modes of generation of hooked ends: (1) Fibres may get hooked during their passage through the transport channel because of their coming into contact with the inner surface of the channel. In this case, the fibres are likely to get buckled at any point along their length, and (2)...

References