How to avoid hairiness variations in core yarns
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1 Point of departure

In a spinning mill a cotton yarn with a Lycra core was produced. The yarn count was Nec 34, and the fineness of the Lycra core was 78 dtex. While testing the yarn in the laboratory a periodic hairiness variation with a wavelength of 34 meters could be noticed.

2 Results

The yarn package was tested in the laboratory with all test modules of the USTER® TESTER 5. For this purpose a test time of 20 minutes and a test speed of 400 m/min was selected. These test conditions were selected in order to see at least 2 or 3 bobbin changes in the diagram within the test period.

The investigations at Uster Technologies could trace back the fault which the customer has recognized. The fault was not caused by mass variations. The diameter measurement also has shown very little variations. However, the hairiness diagram and the hairiness spectrogram could indicate where the fault has its origin.

Periodicities cannot be recognized in Fig. 1 which represents the mass variations. There exist some individual thick places and neps which cannot cause the fault which the customer has claimed.

The spectrogram of the mass variations indicates periodic faults at wavelengths of 1.2 m and 9 cm. The fault at 9 cm is caused by the front roller of the drawbox at the ring spinning machine.
Fig. 3 and Fig. 4 are 2 hairiness diagrams of the same package. The upper diagram shows the start of the test (test length 0 to 500 m). The lower diagram shows a part of the yarn within the package (test length 3000 to 3500 m). A yarn length of 8000 m was tested in total in order to monitor the yarn of more than just one bobbin in the package. A comparison between Fig. 3 and Fig. 4 shows that the hairiness variation can change slightly.

It can be seen very well that the upper and lower diagram look slightly different, depending on the bobbin from where the fault originates.

The spectrogram of the hairiness shows an intensive periodic variation with a wavelength of 34 m (with upper harmonics at 17 m, 11.3 m and 8.5 m). This periodicity indicates that something is wrong with the traversing movement on the ring spinning machine.

In the diagram of the yarn diameter of the USTER® TESTER 5 sensor OM one can hardly recognize the periodic hairiness variation.
However, if the diagram with a cut length of 10 m is printed out (Fig. 6) a slight variation can be recognized (red line). The intensity of the fault is small when measuring the diameter.

As a summary the following statement can be made:
This defect cannot be recognized when measuring mass variations nor can the defect be seen when measuring the diameter of the yarn. However, it is remarkable how intensive the fault can be seen with the hairiness diagrams and spectrograms. If the yarn is inspected visually on a taper board the variation of the hairiness can easily be seen (Fig. 7 / more intensive hairiness between the first two and last 2 arrows).

<Fig. 7 Taper boards>

3 Solution

As a result of this analysis there was a suspicion that the origin of the fault must be caused by the reversal arrangement at the drawbox of the ring spinning machine. The wavelength of 34 m equals one full traversing movement. In this case the spinning mill confirmed that the traversing movement was switched on. The movement of the Lycra yarn changes the tension of the yarn at the spinning triangle. The movement of the yarn does not affect the integration of the fibers into the yarn body, but the hairiness of the yarn is affected depending on the position of the yarn during the traversing movement. Therefore, the fault can only be recognized with the hairiness diagram and spectrogram. The defect could be eliminated by switching off the traversing movement.