

Slub Yarn Production on the Cotton Spinning Machine

انتاج خيوط السلب على ماكينات غزل القطن

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ملخص البحث:

الغزل الحلقي مازال يعتبر الطريقة القياسية للغزل بالرغم من ظهور العديد من طرق الغزل الحديثة في السنوات الأخيرة ويظل هو المعيار الذي يتم بناءا عليه تقييم الطرق الأخرى . وتكمن الميزة الرئيسية في طريقة الغزل الحلقي في امكانية التحكم بدرجة عالية في الشعيرات في جميع مراحل هذه العملية وفي المدى الكبير لنمرة الخيوط التي يمكن انتاجها . تشير هذه الدراسة الى انتاج خيط السلب على نظام الغزل الحلقي باستخدام طرق متعددة ، الاجهزة المختلفة التي يمكن الحاقها باي ماكينات للغزل الحلقي او الماكينات المصممة خصيصا لانتاج خيوط السلب والخيوط متعددة النمرة ، البيانات التقنية والتكنولوجية لهذه الاجهزة ، امكانيات تكوين التأثيرات المختلفة للسلب " سمات الخيط الزخرفي " ، ايضا كيفية تقييم خصائص خيط السلب باستخدام طرق قياسية مختلفة واخيرا الاحتياطات الواجب مراعاتها اثناء عملية الانتاج على ماكينات الغزل الحلقي وادوات تقييم جودة خيط السلب، العيوب، عدد السلب لكل متر، الظروف المحيطة ،النمرة،البرمات والمظهرية للخيوط المنتجة.

Abstract

Ring spinning, in spite of the encroachment of variety of new spinning methods in recent years , is still regarded as the standard spinning method and it remains the benchmark against which all other yarn production process are measured The main advantage of the system lies in the high degree of fiber control available at all stages of the process, and in the wide range of counts it can be produced. The present work indicates the basic operation of the system to produce slub yarn by using several ways, slub yarn making devices and different attachment can be installed on any m/c's , or machine with built in mechanisms for slub yarn and multicount yarn, Technical and technological data for slub yarn devices , the possibilities to create different slub effect " fancy yarn features". Also, how judging slub yarn parameters using different measurements techniques and finally the precautions to be taken while process of slub yarn on ring spinning m/c , tools for evaluation slub yarn quality , control faults, slub per meter, ambient condition, count, twist and appearance of slub yarn.

1. Introduction

In today's environment where margins are squeezed day by day for the conventional yarns, it is more profitable for the spinners to venture into specialty yarn like slub. Slub yarn has gained more popularity today

worldwide in the denim, home furnishings in shirting, in women's fashion and knitting segment. The combination of thickness and random variations ensures a range of effects, so rich that slub spinning is gaining ground in growing number of applications. The slub effect can be

produced by a variety of means, each offering its own benefits and challenges. Most of the yarns produced using Ring spinning, Rotor spinning and hollow spindle machinery that are required special preparation, or modified or specially developed for this purpose.

(i) **On Ring frame:** slub yarn is achieved by varying the speed of the back and middle bottom roller by maintaining the production roller at constant speed. These quick, yet controlled, accelerations produce variations in the base yarn count. The process is suited to all types of fibers "short, long, natural, synthetic or combined" and yarn count.

(ii) **On Open End frame:**

The slub is produced by modifying the speed of feed roller of the fiber strand. The special fancy effect of rotor spun is characterized by long slub and this effect is quite different from ring slub yarn (1).

(iii) **On Hollow Spindle m/c:**

A special effect of slub "spiral or bound", is in effect, a combination yarn, in which an additional binding process has been applied using hollow spindle to create the visual effect of slub yarn rather than on ring frame (2).

Fancy slub effect yarn may be divided into different classes, as shown in the earlier work (4), these are (2, 3).

(i) Spun slubs.

(ii) Flake "very long slub" yarns.

(iii) Ground slub yarn "fine or/and heavy slub effect"

(iv) Plucked-in "or inserted alub yarn".

(v) Bound or spiral slub yarn,

(vi) Single slub yarn.

(vii) Two ply slub yarn.

The next paragraph (3) offers more details on slub yarn produced using spinning frame.

2. Definitions of slub yarn (5, 3, 6, 7)

A slub yarn is one in which slubs have been deliberately created to produce the desired discontinuity of effect. The existing references of slub yarns produced at Ring spinning frame, presents several criteria used to define slub yarns such as: Structure "type of effect", method of manufacture, use of yarn, or combination of all. The definition have been grouped logically as following:

1st group: with yarn structure:

- The diameter of yarn increases than regular yarn to meet some desired effect
- There is regular or irregular intervals in the yarn
- It has desired type of slub in length and thickness at required distance
- Slubs in the yarn be in patterning or anti-patterning to produce fancy fabric

2nd group: with slub specification, count and twist

- Can be defined by three parameters, slub thickness, slub frequency, slub per meter and slub length

- It is a yarn of definite or different count with diameter changing at different lengths
- It may have different twist "multi twist, different count "multi count" and combination of all.

3rd group: with Method of manufacture:

- Principle of producing slub fancy yarn is based on roller drafting system. The drafting is deliberately interrupted to produce thick places at random intervals in the final yarn(5)
- Slub is created by varying the speed of the feed roller keeping the front roller speed constant. the overfeed produces slub in the yarn or varying front roller speed to produce slub yarns in multicount-multitwist , multicount-single twist patterns

4th group: with use of yarns

- Because of its special appearance slub yarn has been widely used in variety of garments.
- Yarns having short thick places of specific dimensions arranged in defined patterns, it is suitable to use as weaving and hosiery yarn and give aesthetic and special attraction in the plain or apparel fabrics.

3. Slub yarn production on Ring spinning frame:

3.1 Ways of yarn Manufacture (3, 5)

Normal yarn: In the production of a normal yarn, the attenuation of the fiber strand should be achieved with minimum variation in its linear density. This results in the maximum

yarn regularity. Since fibers of different lengths will tend to move differently during drafting, this is not necessarily easy to accomplish. The differing behavior of fibers of different length will cause yarn irregularity. For this reason the drafting aprons in the front drafting zone were developed in order to improve the fiber control and therefore to minimize the variation in plain yarn production.

Slub yarns: there are several ways of producing slub yarn on the ring spinning frame:

(i) On Ring frame during the production of fancy slub yarns, the drafting apron can be removed and the resulting uneven movement of the fibers can be exploited to create deliberately - introduced random variations in the yarn. This effect may be enhanced by mixing fiber of different lengths to exaggerate these variations in yarn thickness. For example, woollen slubbing can be mixed with worsted Top sliver, to create a yarn in which the imperfect fiber control during drafting produces randomly disturbed slubs (Thick places) of varying dimensions. Again, the final spinning process is simple and easy to set up, but in this case it is at the expense of being required to produce a sliver or roving that blends these differing yarns. This allow of spun yarn produced

(ii) Further modifications to the drafting system have been developed that make possible the use of differing yarn paths to the spinning head. Each of these can be separately controlled and each is provided with drafting aprons for better fiber control in order to allow the differential drafting of several slivers or rovings during feeding.

automatic electronic equipment (microprocessor based) instead of conventional mechanical equipment.

6.6 In post – Spinning stage (winding)

- In auto coner optimum speed to be selected. Speed should be reduced than normal yarn.
- Lower unwinding tension by optimizing balloon breaker setting, set the yarn tension to avoid yarn breakage in unwinding zone.
- Yarn tension at the time of winding to be kept 10 – 15% lower than the same normal yarn.
- Lower cradle pressure to avoid yarn rubbing with drum
- Reduce touching point in cone winding machine while slub yarn process in winding section.
- EYC setting at auto coner should be optimized based on slub thickness and length to ensure no slub is eliminated except bad or loose slub. (setting should be optimized as per slub specification).
- Open / wider setting in cone winding to be maintained to avoid unnecessary cut at winding (PC alarm should be off).
- Setting in winding should be kept wide enough to avoid damage to slub.
- Computer aided clearing could prove better for adjusting clearer curve to retain slubs of parent yarn.
- The pre cleaner setting and loop gate settings in auto coner should be wide enough to avoid slough off.
- Pre clearer setting in auto coner should be widened depending upon cost/slup.
- Clearing curve to be optimized in auto coner to avoid chances of slub being cut.
- When converting cops into cone, yarn clearers should be set in such a way that, not to cut the slub portions.
- All channel setting to be opened to keep the winding cuts as minimum as possible
- Proper attention should be given for cone hardness.
- Cone hardness should be kept within 0.55, so that slough off cannot be taken place at the time of cone unwinding.
- Preferred package is cheese “for coarser counts” however cones with conicity of 30 to 30’ can also be used “for finer slub yarns”.
- Splicing quality / strength to be monitored. It plays an important role in deciding the performance in downstream m/c's.
- Yarn may be conditioned to improve performance in down streaming process .
- Workers should be trained to know about the slub yarn so that defective yarn may not be produced.
- Supervisors and spinner are motivated to check the slub delivery by watching of the two chains regularly.
- Base yarn and slub yarn count to be checked time to time
- Distance between slubs should be as per buyers requirement. Randomness of the intended slub effect should be taken care off. Slub length and slub thickness be as per requirement.
- Slub pattern must checked at the time of new count start from Q.C. Dept. and cross check the slub effect after every doff by supervisor. There will be some chances of missing synchronization and produced normal yarn.
- Repeat pattern / wrong setting of program should be avoided.
- Individual size of slub, their distribution, mass increase to be measured time to time, frame to frame and batch to batch for producing consistent result.

- Avoid to make small lengths of slubs and creation of thin places adjacent to slubs i.e, to ensure gradual thickening and tapering of slubs.
- Slubs produced should have same specifications should be same for all spindles from gear end to off end and machine to machine.
- The slub yarn produced is to be compared with samples given to customer by blackboard appearance or testing equipments.
- All the slub parameters are to be thoroughly checked.
- Quality checking periodically by inserting in the fabric.

6.77 Maintenance

- Ensure placing slub device away from dust, dirt, heat and humid atmosphere.
- Timely checking and maintenance of slub attachment, which gives the required electrical impulses for building the slub and transforms speed and acceleration is desirable.
- In gearing cut method, the condition of the gears should be checked regularly at spinning. In Random generated slub method, magnetic clutch and gear conditions should be checked regularly at spinning in electro mechanical method, proximity switch, cam conditions should be checked regularly in spinning. In plucked slub method, optimum quality of foundation threads and twist less roving are used.
- Problems may occur at delay change slub/ support. It is better to choose a higher delay that at normal production to maintain a standard delay.
- Control the belt tension of the special belts once a week. It should be free of fibers.

- Grease the spiral toothed, tempered drive gear wheels between servomotor and differential gear with lugh grade adhesive fat once a week.

6.8 Quality Inspection

6.8.1 Uster tools for evaluation slub yarn quality

- Uster mass diagram / spectrogram to be monitored for slub
- Slub yarns characteristics should be checked frequently by G.A through scatter plat, histogram, slub sequence diagrams, spectrograms and impressive 3-D displays.
- It always better to cross check the quality of the slub yarn spectrograph, vertical diagram and imperfections) on a daily basis with the help of evenness tester (UT3/UT4/UT5) to ensure that, the preset program and the actual yarn produced are matching.

6.8.2 Control Faults in slub yarn using fancy yarn profile:

USTER (41) developed new tool" Fancy yarn profile to fulfill the requirements of slub yarn producers, knitters and retailers. The report (SE 614) deals with how to use its results to detect typical faults. These are:

- i) Slub yarns not meeting the requirements
 - Missing slubs over long distance
 - Slubs not being produced correctly
- ii) Randomness of the intended slub effect (outlier)
- iii) Yarn mix-ups (wrong bobbin/
- iv) Predicted faults (short term/long term)
- v) Repeat patterns.

In the following section these typical faults are described in detail and give recommendations how to detect them.

i- Slub yarns not meeting the requirement.

It is possible that slubs are not being produced correct or are even missing over a certain length.

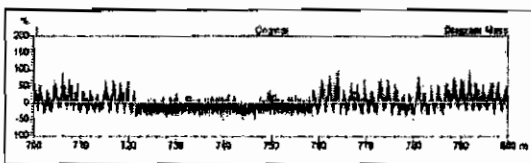
- Depending on the cause, the distance without slubs can be longer or shorter.
- This kind of fault will hardly influence the mean value of numerical results but it will show up in high values for the slub distance max and min it will be visible in the mass diagram.

i-1) Missing slubs over a long distance

Fig(5)

The slubs were not produced over a certain length.

- It can be considered as serious faults.
- It has damaging effects on the fabric appearance later on.



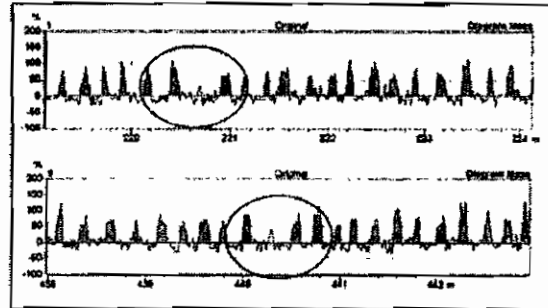
Fig(5) Mass diagram with missing slubs over a long distance

i.2) Slubs not being produced correctly

Fig(6)

- The mass increase of the slub is too low. This attributed to: The drive of the slub insertion system is not strong enough to produce the slub over the whole m/c as defined in the slub program.

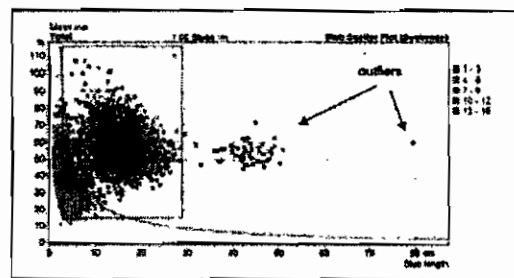
- It becomes visible in fabric appearance later on.



Fig(6) Missing slubs in the diagram

ii) Outliers Fig(7)

- An outlier is defined as a slub which does not the defined specifications regarding the slub length and the mass increase of the slub
- It can be easily detected in the slub scatter plot, or in the numeric values for the number of outlier per km
- Analyzing the mass diagram Fig(7), the reason for outliers slubs were not separated during the production i.e. the slub distance between the slubs was missing

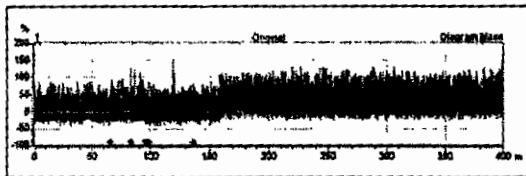


Fig(7) Scatter plot with outlier

iii) Yarn mix-up

- The mix up of yarns is a serious fault.
- It occurs due to wrong bobbins, or two different kind of slub yarns” were wound together on the winding machine / or were found in one batch.

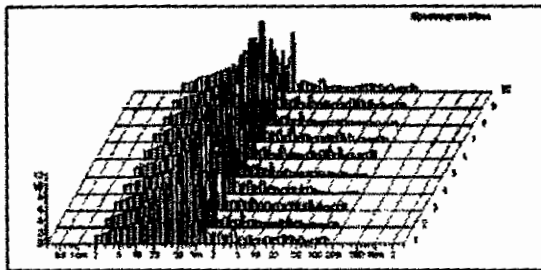
- This will lead to severe changes in the fabric.
- It becomes visible in the mass diagram Fig(8) as well as in the sequence diagram and in the scatter plot of the yarn



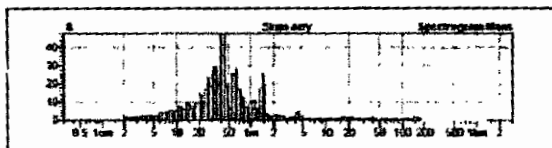
Fig(8)Mass diagram of two different slub yarns on a cone

iv) Periodic Faults

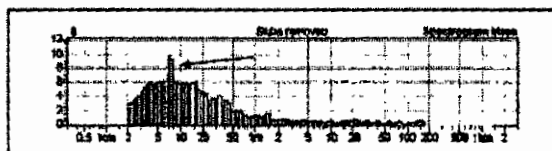
- Periodic faults in the slub yarn, occurs from defective parts of prior processes or of the spinning machine.
- It becomes visible by separating the mass spectrograms of slub and base yarn Fig (9),and Fig(10) from combing spectrogram Fig(11).



Fig(9) Spectrograms, combines



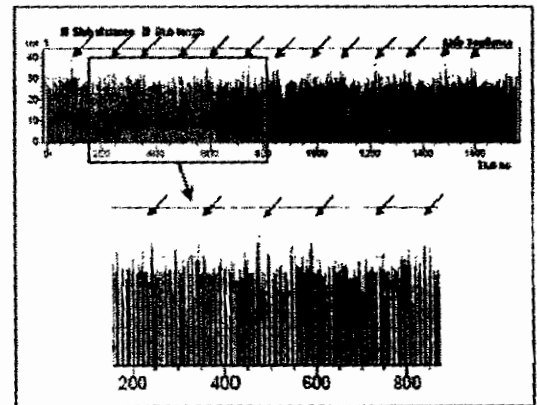
Fig(10) Spectrogram , slub only



Fig(11) Spectrogram , slub removed

v) Repeat patterns :

- Repeat patterns one of the most critical faults.
- It caused by wrong settings of the slub program.
- It can only be detected in sequence diagram Fig (12).



Fig(12) Sequence diagram with repeat pattern

Thus the spinner should be carried out program checking schedule:

- All the cops should be checked by the investigator for missing slub outliers and any kind of mix – up.
- On line quality measurement systems or spectrogram checking schedule must be followed very strictly.

6.8.3 Control slub per meter

- Slub / meter should be checked in UT4 to verify the slub frequency.
- Slub/ meter should be equal in cop and cone. Reduction of slub / meter in cone when compared to cop is an indication of cut of slub in auto coner.
- Number of slub per meter, diameter of slub etc. should be monitored frequently to avoid rejections.

6.8.4 Control count, Twist and Appearance of slub yarn

- Count and Twist parameters should be checked in order to get the required count of slub yarn.
- Yarn Appearance on black board should be checked periodically for slub pattern.

6.8.5 Control Ambient condition

- There should not be any thin places after slub which causes breakage.
- Ambient conditions should be strictly monitored and maintained at the required level to avoid higher breakage rate "i.e effective control of humidity and temperature "

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