Study on Wear Resistance of Glass Fiber Yarn Weaving Process

Glass fiber weaving performance overview

Since its founding in 1938, the glass fiber industry has been developing for more than 60 years. Its production, production technology, variety specifications and application areas develop continuously. According to incomplete statistics, now the world has more than 30 countries to produce glass fiber, varieties of four or five thousand kinds, and now the proportion of international glass fiber applications, glass fiber fabric accounted for 12%.

The glass fibers are passed through the wire and twisted, as warp and weft, and then intertwined or mixed with other fibers such as cotton to a certain tissue fiberglass fabric or mixed fabric. Glass fiber products fully learn from cotton and other mature weaving process In the initial stage, In the ordinary loom such as 1511,1515 to complete. However, because the glass fiber has a strong rigidity, holding force is small, poor flexibility, elongation and other characteristics, so its weaving is different from the ordinary fabric. In particular, due to the wear resistance of glass yarn, torsion resistance, bending performance and shear performance is particularly poor and so on, so in the weaving process encountered many problems. Because of the damage rate, these characteristics has seriously affected the production efficiency of its weaving. According to the characteristics of glass yarn, the processing steps are as little as possible. Therefore, compared to the ordinary yarn weaving process, the glass yarn does not pass through the winder process, and the wire and twist the yarn directly used for warping. In addition, due to the traditional shuttle loom and glass yarn itself, its speed is difficult to improve. People try to produce glass cloth on more advanced looms. Now, the use of shuttleless jet air jet weft has a small amount of use, weaving thin fabric has a good effect. In addition, there are shuttle rapier weft looms that are

also used to produce glass fiber cloth.

Glass fiber yarn abrasion resistance test

practice shows that the wear resistance of glass fiber yarns plays a decisive role in the process of processing, especially in the weaving process. Many of the breakage is caused by the wear of the yarn, and the glass fiber yarn in the weaving process due to friction and fluff also directly affect the glass fiber fabric surface properties and mechanical properties.

Test conditions: Temperature: (20 ± 1) ° C

Humidity: (65 ± 2)%

Air pressure: 1.013 × 105Pa

Test equipment: Y731 holding machine

Determination of test factors

Ordinary fiber or yarn wear resistance by the following factors: the molecular structure of the fiber and microstructure; The conditions of the wear process, such as the temperature, the tension of the specimen, the type of the abrasive, the shape, the size of the particles, the sharpness, the hardness, etc., especially the abrasive properties, the ratio of the hardness of the fiber and the surface of the yarn to the surface hardness of the abrasive are particularly important.

As the test sample used is the same kind of glass fiber, Its molecular structure has little effect on the comparability of trial and error, so do not consider factors. And the temperature and humidity can be controlled by the laboratory equipment according to certain standards, it is not considered. As for the characteristics of abrasive, such as type, shape, particle size and other factors, because the test is using the same instrument, and its abrasive hardness is good, basically remain unchanged, it will not produce the abrasive characteristics of the instrument

changes and bring the error, does not affect the test value of the comparable, so the factors can be ignored.

Sample tension is a very important factor, according to experience, the sample tension on the fiber or yarn has a more significant impact. In the weaving, the tension is also a very critical factor, the value of its size and uniformity directly affect the fabric production, quality, therefore, the factors must be taken into account.

In addition, the microstructure of the yarn on the test also has an impact, so the yarn varieties as the second factor of this test, compared with its twist and twist and the difference between the performance of different branches.

As the ultimate goal of this test is to improve the weaving properties of glass fiber, it is also considered the impact of weaving factors. In addition to the above mentioned tension, there are weaving when the integrated speed; the components, especially the reed and the angle of friction between the yarn and other factors. In general, the speed of the bending machine of the shuttle loom is 180 ~ 220r / min, while the speed of the central axis is half, that is, 90 ~ 110r / min. And the friction angle depends on the different fabric, different opening height, different depth of the difference between the different may be.

Factor level and test plan

Factors to determine the level of taking into account the following two aspects: the sample varieties, one is to meet the most commonly used, the largest production volume, the other three factors, then take the closest to the actual production. The second is to make the contrast more obvious. The So the yarn varieties take 4 levels, the other three factors take 2 levels. According to the orthogonal test design to determine the glass yarn test program is as follows:

Test results

Using the statistical analysis in Excel, according to the least squares method, the multi-linear regression equation of wear resistance of glass fiber yarn is obtained as follows:

$$y = m_1 x_1 + m_2 x_2 + m_3 x_3 + m_4 x_4 + b$$

$$y = -9.44x_1 - 3.87x_2 - 1.23x_3 - 1.26x_4 - 9.10$$

Analysis of results

Yarn varieties

From the test results we can see:

K1=1504;K2=1710;K1<K2

This shows that the twist yarn, the greater the yarn, the worse the wear resistance of the yarn. From the general law, the more thick yarn, the more wear should be. On the other hand, the thicker the yarn, the greater the degree of squeezing between the blade and the yarn, and the more severe the wear. In addition, the larger the diameter of the yarn, the composition of the fiber diameter of the yarn is also larger, the larger the diameter of the fiber, the softness of the worse, in the case of twisting after twisting Not wearable.

(2) 12 × 1S0 and 24 × 1S0

From the test results we can see:

K3=2640;K4=7472;K3<K4

This shows that for the untwisted yarn, the smaller the yarn count, the worse the wear resistance of the yarn. In the abrasion resistance test of the untwisted yarn, although the greater the yarn count, the greater the contact area of the yarn, but because there is no twist, so the yarn is more dispersed fibers. When the blade is

ground from the surface of the yarn, the fibers in the yarn are essentially paved. Therefore, the fiber diameter of the fiber composition of the larger yarn is also more wear-resistant yarn.

(3) 12 × 2S110 and 24 × 1S0

From the test results we can see:

K2=1710;K4=7472;K2<K4 This shows that the twist yarn than the untwisted yarn wear resistance is poor, and the difference is relatively large. The main reason for this phenomenon is that twisted yarn in the twisting process has been torsion, shear and wear and so on, its strength, wear resistance and other properties have declined.

Effect of tension

From the test results we can see:

When the tension is 0.49N · m, K1 = 5793 when the tension is 0.37N · m, K2 = 7375 and : 50/38 = 1.31, K2 / K1 = 1.27 The ratio of the two is approximately equal, It can be seen that abrasion resistance decreases as the tension increases, and the two are approximately proportional. Take the test results Average:

u1=K1/120=5793/120=48.3

u2=K2/120=7357/120=61.3

To establish the regression equation:

$$y = -\frac{13}{12}(x - 38) + 61.3 = -\frac{13}{12}x + 102.5$$

Given the number of wear resistance y ≥ 10, then: x ≤ 85.4

That is, x = 85.4 (when the tension is greater than 85.4g), the wear resistance of the yarn will not be suitable for weaving, so for the test conditions of the yarn varieties, 85.4g for the tension threshold.

Conclusion

(1)The tension of yarn varieties and samples was significant factor, and the yarn varieties were highly significant factors. The wear angle and velocity had no significant effect on the test results.

(2)the higher the wear resistance of the twist yarn, the worse the abrasion resistance of the twist yarn, the greater the abrasion resistance of the untwisted yarn; the wear resistance of the untwisted yarn is better than that of the twisted yarn; The worse the wear resistance of the thread, and the existence of tension threshold.