Study on the Influence of the Main Parameters of Woodworking Saw Blade on the Illumination Value of Band Saw Blade (1)

Jin-gui GAO¹, Hong-gang ZHAO¹* and Lai-peng LUO¹
¹Beihua University, Jilin city of Jilin province, 132013, P.R.China

E-mail: *1125568071@qq.com

Abstract. In this paper, MJ3310A band saw machine as the research object, through the Beijing VIBSYS vibration signal acquisition and analysis software illumination value analysis, analysis of different circumstances to find good and crack band saw blade illumination value of the law. The results show that the illuminance of the cracked band saw blade is significantly higher than that of the complete band saw blade illumination value. Under the optimum working conditions, if the band saw blade illumination value exceeds 286 Lux, it can be determined that the band saw blade has at least one crack length greater than 1.68 mm Of the defects, the need for timely replacement band saw blade. So as to rational use of band saw blade, band saw blade on-line fault diagnosis provides a technical basis.

1. Introduction
According to the actual production survey, the woodworking band saw blade has its fault state and the eye can not be observed, but can not determine the correct replacement time [1-3]. At present, wood processing enterprises online inspection usually use light to determine the situation of cracks. Whether or not this inspired band saw can be used for online troubleshooting. According to the new data, on the use of light measurement method (illumination value) for band saw blade crack in-depth study - the occurrence of cracks in the law at home and abroad rarely. From the experimental study of its crack based on the results of less. In order to determine the time of replacement of band saw blades in actual production, it is necessary to study the generation and propagation of cracks before and after cutting under different load conditions. In order to improve the quality of wood surface treatment, to determine the choice of band saw blade reasonable replacement time and online nondestructive fault diagnosis to provide a scientific basis.

2. The experiment main instruments and equipment
2.1. The experiment main instruments
The apparatus and equipment used in this test are shown in Table 1.

2.2. MJ3310A specific parameters of the woodworking band saw machine
The test and application of Tianjin forestry cutting tool factory production of No. 18 B.W.G band saw blade. Show.
Table 1. Test apparatus and equipment.

| Name                          | Model     | Manufacturer                                      |
|-------------------------------|-----------|---------------------------------------------------|
| Woodworking band saw          | MJ3310A   | Shenyang Shen He woodworking machinery factory    |
| The large capacity data       | WS - 5942-2-5 | Spectrum of Beijing century technology development co., LTD. |
| acquisition instrument quickly |           |                                                   |
| Precision multi-function digital light meter | GSM1020A | Shenzhen shigeru source technology co., LTD.       |
| High brightness adjustable    | S6A       | Shenzhen shigeru source technology co., LTD.       |
| micro digital projector       |           |                                                   |

2.3. Cutting wood
The parameters of the test wood are shown in Table 2.

Table 2. Test apparatus and equipment.

| Tree species | Moisture content | Cutting thickness |
|--------------|------------------|-------------------|
| Manchurian Ash | 10%              | 100mm             |

3. Test data processing and result analysis

3.1. Cutting wood of different wood species to crack defects of band saw blade illuminance value influence
In the determination of the saw wheel spindle speed 900rpm, pressing the weight of 93N, saw blade up and down distance of 650mm, feed speed of 15m / min, under the premise of cutting five kinds of tree birch, color wood, poplar, oak, respectively The complete saw blade and the cracked length of 1.68mm for the defect band saw blade for data collection, the saw blade cutting tree species are different and the band saw blade illumination value of the collected data drawn as shown in Figure 1.
It can be seen from Fig. 1 that the strip saw blade increases with the increase of the feed rate. The band saw blade illumination value changes smoothly, and the cracked band saw blade increases with the feeding speed. The saw blade illumination value also increases; More than the other wood illumination value is small, the largest oak wood, complete band saw blade 32.8LUX, defect band saw blade 454LUX; poplar: complete band saw blade 42.4LUX, defect band saw blade 723LUX; birch: complete band saw blade 43.8LUX, Saw blade 776LUX; elm: complete band saw blade 48.9LUX, defect band saw blade 782LUX; color wood: complete band saw blade 51.7LUX, defect band saw blade 1060LUX; oak: complete band saw blade 58.4LUX, defect band saw blade 1730LUX, cracked band saw blade The illuminance value is generally greater than the illumination value of the complete band saw blade. White pine in the five kinds of tree species in the hardness of the smallest, the largest hardness of oak, which shows that with the increase in the hardness of wood cutting, the illumination value also increases.

Figure 1. Saw blade cutting different tree species when the full saw blade and crack defects generated by the comparison of the value of the blade
3.2. Influence of Rotation Speed of Saw Blade on Belt Saw Blade's Illumination Value
In the band saw machine pressure Tuo weight of 93N, up and down the saw blade distance of 650mm, feed speed of 15m / min, cutting under the premise of wood, in the five kinds of sawing wheel speed, respectively, the crack is 1.68mm defective belt Saw blade and complete (intact) band saw blade for data acquisition and analysis, get band saw blade illumination value curve shown in Figure 2.

![Figure 2](image)

**Figure 2.** Under the load of different saw blade spindle speed on the full saw blade and crack defects in the band saw blade illumination value.

It can be seen from Figure 4, the saw wheel spindle speed on the band saw blade illumination value is very obvious, saw wheel spindle speed before 1000rpm with the saw wheel speed increases when the saw blade illumination value increases smaller, saw wheel spindle speed after 1000rpm, With the saw wheel speed increase band saw blade illumination value also increases; intact band saw blade illumination value 26.1LUX-36.8LUX, defective saw blade illumination value between 612LUX ~ 1800LUX.

3.3. Load under different crack band saw blade's influence on the band saw blade illumination values.
Saw in saw blade tensioning force of 8320 N, rotation number is 1000 RPM, the feed speed of 20 m/min and saw cuttingelm card a distance of 600 mm, under different crack length of band saw blade, band saw blade transverse vibration displacement signal sampling got crack length with the band saw blade transverse vibration displacement curve as shown in Fig. 3.

The Fig.3 shows, under the load with the band saw blade saw blade transverse vibration displacement when the increase of crack length is less, the sawing machine to achieve the best work state, defective blade illumination values between 657 LUX ~ 1325 LUX.

![Figure 3](image)

**Figure 3.** Different crack length band saw blade and the band saw blade the relationship between the illuminance values.

3.4. Influence of Weight on the Radius of Saw Blade
The speed of the saw blade is 1000rpm, the distance between the upper and lower sides of the saw blade is 600mm, the feeding speed is 20m / min, under the premise of cutting the color wood, change the weight of the five times, respectively, to the full saw blade and the crack length is 1.68 Mm defect
band saw blade for data collection, now with the pressure lump weight increases the band saw blade illumination value of the collected data drawn into a curve shown in Figure 4.

![Figure 4](image_url)

**Figure 4.** Under the load of different pressure Tuo weight on the full saw blade and the occurrence of crack defects saw blade illumination value

It can be seen from Fig. 4 that the band saw blade increases with the weight of the pressure mound, and the illuminance value of the band saw blade increases with the increase of the weight of the pressure mound. After the weight of the weight is 93N, the load With the increase of the weight of the pressure mound, the band saw blade illumination value also increases. After the weight of the pressure mound is 93N, the increase of the value of the band saw blade increases with the weight of the weight. The influence is very obvious. Intact band saw blade illumination value 22.4LUX-33.4LUX, defective saw blade illumination value between 711LUX-980LUX.

3.5. **Influence of Upper and Lower Saw Card Distance on Illumination Value of Belt Saw Blade**

In the band saw machine spindle speed of 900rpm, pressure Tuo weight of 93N under the premise of band saw blade crack 1.68mm, change the distance from the top and bottom of the saw, respectively, the complete saw blade and crack defects of the blade for data collection, Saw card up and down the distance to get the band saw blade illumination value of the collected data drawn into a curve shown in Figure 5.

It can be seen from Fig. 6 that the band saw blade is smooth with the increase of the distance between the upper and lower saws. With the increase of the distance between the upper and lower saws, the value of the band saw blade increases with the increase of the distance between the upper and lower saws. Small, up and down saw the distance from 600mm, with the increase in the distance from the saw blade, the illumination value increases greatly. This is due to the increase in the length of the band saw blade, band saw blade vibration increased the reason. Intact band saw blade illumination value 35.2LUX-44.6LUX defective saw blade illumination value between 721LUX-2690LUX.

![Figure 5](image_url)

**Figure 5.** Influence of Upper and Lower Saw Card Distance on Illumination Value of Belt Saw Blade

3.6. **Influence of Different Saw Height on the Illumination Value of Crack Band Saw Blade**
The saw blade tension force 8330N, the number of revolutions of the saw blade 900rpm, the feeding speed of 15m / min, the distance from the upper and lower saws 650mm, the cutting oak, the transverse vibration of the band saw blade was collected under different height conditions of sawing and the crack length The relationship between the illuminance value and the band saw blade is shown in Fig 6.

It can be seen from Fig. 6 that the band saw blade increases with the height of the saw blade. The change of the band saw blade is smooth. The influence of the height of the saws on the saw blade is very obvious. With the increase of the saw height, The increase. Intact band saw blade illumination value 32.8LUX-58.4LUX, defective saw blade illumination value between 454LUX-1730LUX.

![Figure 6](image)

**Figure 6.** Different band saw blade saw road height on the influence of the band saw blade transverse vibration displacement.

### 3.7. Influence of Rotation Speed of Saw Blade on Belt Saw Blade’s Illumination Value

In the band saw machine pressure Tuo weight of 93N, up and down the saw blade distance of 650mm, feed speed of 15m / min, cutting under the premise of wood, in the five kinds of sawing wheel speed, respectively, the crack is 1.68mm defective belt Saw blade and complete (intact) band saw blade for data acquisition and analysis, get band saw blade illumination value of the curve shown in Figure 7.

It can be seen from Figure 7, the saw blade spindle speed on the band saw blade illumination value is very obvious, the saw wheel spindle speed before 1000rpm with the saw wheel speed increases when the saw blade illumination value increases smaller, saw wheel spindle speed after 1000rpm , With the saw wheel speed increase band saw blade illumination value also increases; intact band saw blade illumination value 26.1LUX-36.8LUX, defective saw blade illumination value between 612LUX ~ 1800LUX.

![Figure 7](image)

**Figure 7.** Under the load of different saw blade spindle speed on the full saw blade and the occurrence of crack defects band saw blade illumination value

From the test analysis shows that, for the MJ3310A sports car wood saws, the use of 120mm width of the saw blade, band saw blade after the crack after the lateral vibration significantly increased, this time to determine the saw blade is the replacement time. When the saw wheel spindle speed, pressure lump weight, feed speed, the upper and lower saw the card distance are adjusted to the most appropriate circumstances, the determination of lateral vibration displacement if more than 286LUX
above, then the blade has produced at least one crack length of more than 1.68mm. Of the crack defects, the need to replace the band saw blade in time; in addition to the use of band saw blade lateral vibration displacement changes can determine whether the band saw blade defects.

4. Summary
Through above MJ3310A type sports car woodworking band saw machine test and analysis, the following conclusions:

(1) The illuminance value of the complete band saw blade is significantly lower than the defective illumination value.

(2) With the increase of the feed rate, the illumination value of the band saw blade is increased and the illumination value increases with the increase of the feed rate.

(3) Sawing white pine band saw blade illumination value than other wood illumination values are small, the largest oak, white pine minimum: crack with band saw blade illumination value is generally greater than the full band saw blade illumination value. White pine in the five kinds of tree species in the hardness of the smallest, the largest hardness of oak, which shows that with the increase in the hardness of wood cutting, the illumination value also increases.

(4) In type MJ3210A sports car woodworking band saw machine, using the 130 mm width of blade, blade judge whether the need to change, can be judged from the change of the saw blade vibration displacement, when saw wheel spindle speed, pressure tuo weight, saw card distance to adjust up and down to the most appropriate cases, the determination of illuminance values if more than 286 lux, then saw blade has had at least one crack length more than 1.68 mm crack defects, need to replace the band saw blade in time.

Funding for the subject project
This topic by the Chinese national natural science fund project funding, its national fund name: based on the analysis of time series of woodworking band saw blade tooth crack and damage formation mechanism and prediction theory (31570556). Key scientific research project of jilin province department (2015204038 NY). Lower level table plate laser cutting spelling solid mu fu joins a floor board, research and development.

References
[1] Jin-gui Gao, Jian Zhang, Hui Li, and so on. Band saw blade off the horizontal vibration displacement and main frequency variation before and after tooth. Journal of north China university (natural science edition) [J]. 2016, (4) : 549-552.
[2] Feng Dong Dong, Wan Yi Shang. Based on laser displacement sensor of band saw blade tooth online detection system research [J]. Journal of tool technology, 2016, 50 (3) : 82-85.
[3] Jin-gui gao, Zhiping Zou. Band saw blade crack before and after vibration analysis [J]. Journal of fujian forestry science and technology, 2014, 9 (3) : 115-120.