

The Processing Process of Surface Texture

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Abstract: Surface texture refers to the friction surface with a certain geometric morphology, size and distribution of the pattern, which play to improve the friction surface contact and lubrication of the role of the state. This paper elaborates the process of making the surface texture by 3D printing die, and verifies its feasibility by experiment.

Keywords: Surface texture, 3D printing, Silicone Rubber

1. INTRODUCTION

Surface texture refers to the friction surface with a certain geometric morphology, size and distribution of the pattern, which play to improve the friction surface contact and lubrication of the role of the state. It is proved that the appropriate surface texture can effectively improve the friction coefficient of the flexible friction. Therefore, the working mechanism of the surface texture in different working conditions and lubrication modes is studied and the optimal surface shape is determined. Surface friction performance has a greater application value, to improve resource utilization, extend the life of the machine has important significance [1-2].

At present, there are many domestic and foreign scholars put forward a variety of surface texture processing means. Qian Shuangqing mainly deals with the surface texture processing technology of the surface texture of several tens of micrometers to hundreds of micrometers. The electrolytic processing is the principle of using the anode of the workpiece to dissolve in the electrolyte [3]. Processing of a forming technology. The micro - abrasive multiphase jet machining technology for machining the surface texture of mechanical seal is proposed, and the processing device, technical flow and process parameters are studied and explored [4]. Wu Wei et al. Used different laser output power, repetition frequency and scanning speed to process the trench surface texture on the surface of high speed steel. A three-factor comprehensive experiment was designed. The machining parameters and trench texture parameters The results show that with the increase of laser repetition frequency, the depth and

width of trench texture tend to decrease slightly and then decrease [5]. Liu Zhi-yong et al. Designed the mechanical structure of the fiber laser table based on the surface texture work environment, technical requirements and research content. The software and hardware control system of the fiber laser and galvanometer was developed to make it a titanium alloy surface Texture of the experimental equipment [6].

2. PREPARATION OF SURFACE TEXTURE

From the surface texture preparation process, the preparation process of the surface texture is similar to that of the general elastomer, which is divided into three stages: mold preparation, homogeneous mixing and high temperature curing.

2.1 Preparation of preparation materials

The surface texture is mainly composed of silicone rubber and curing agent. The content and proportion of silicone rubber and curing agent have a great influence on the performance of the prepared surface texture. If the curing agent content is higher, the proportion is too large, will lead to the preparation of the surface texture hardness increases, while brittle strong. Generally, the modulus of elasticity of the surface texture after curing is relatively small, so the amount of curing agent used in the preparation process to reduce the viscosity of the matrix material before curing and elastic modulus after curing play an important role.

There are many varieties of matrix materials used to prepare surface textures, but silicone rubber and natural rubber are the most widely used matrix materials. Surface texture matrix material needs to meet the conditions:

- 1) The matrix material requires good stability and permanent deformation.
- 2) Curing agent requirements can adjust the hardness and elasticity of the surface texture after curing.

Based on the above considerations, the surface texture of this article in the preparation process selected Dow Corning 184 silicone rubber, Dow Corning 184 silicone rubber for the two-component high temperature vulcanized silicone rubber, including polymer raw materials and curing additives two components, the use of quality ratio is 10, and Dow Corning SYLGARD 184 silicone rubber in the 25 ~ 150 °C temperature range curing, no exothermic phenomenon, no secondary curing. Its basic performance to meet the above requirements. Its performance as shown:

Table 1 The basic properties of 184 silicone rubber

| Before curing | |
|----------------------|-------------------|
| Viscosity(25 degree) | 5500cps |
| After curing | |
| Exterior | Transparent |
| Tensile Strength | 6.20MPa |
| Thermal conductivity | 3.5×10^4 |
| Brittle point | -65 degree |

2.2 Preparation of specific processes

2.2.1 The surface texture is required for the preparation of the tool

(1) Electronic balance

The electronic balance chosen in this paper is HZT-A + 200 electronic balance, as shown in the figure, the main parameters are: weighing stability time ≤ 3 seconds, range 0.01g-200g. Mainly used to weigh silicone rubber, curing agent and beaker, used to prepare a certain volume ratio of the surface texture.



Fig.1 HZT-A+200 type electronic balance

(2) Ultrasonic cleaning machine

This paper chooses JP-010T ultrasonic cleaning machine, as shown in the figure, JP-010T ultrasonic cleaning machine main parameters: the maximum capacity of 2.0L, ultrasonic frequency 40KHz, ultrasonic power 80W. The Mainly used for cleaning to mold, beaker, stir bar and other experimental devices to ensure the effectiveness of experimental data.



Fig.2 Ultrasonic cleaner

(3) Vacuum drying oven

In this paper, DZF-6022 type vacuum oven, as shown in the figure, DZF-6022 type vacuum oven main parameters: to achieve vacuum degree 133 Pa, temperature range of room temperature +10 ~ 200 °C. The Mainly used to remove silicone rubber and curing agent mixing when mixed with air and for curing silicone rubber.



Fig.3 Vacuum drying oven

(4) 3D printer

This article selected Hongrui Z300 type 3D printer, as shown, mainly used to print the surface texture used to prepare the mold.



Fig .4 3D printer

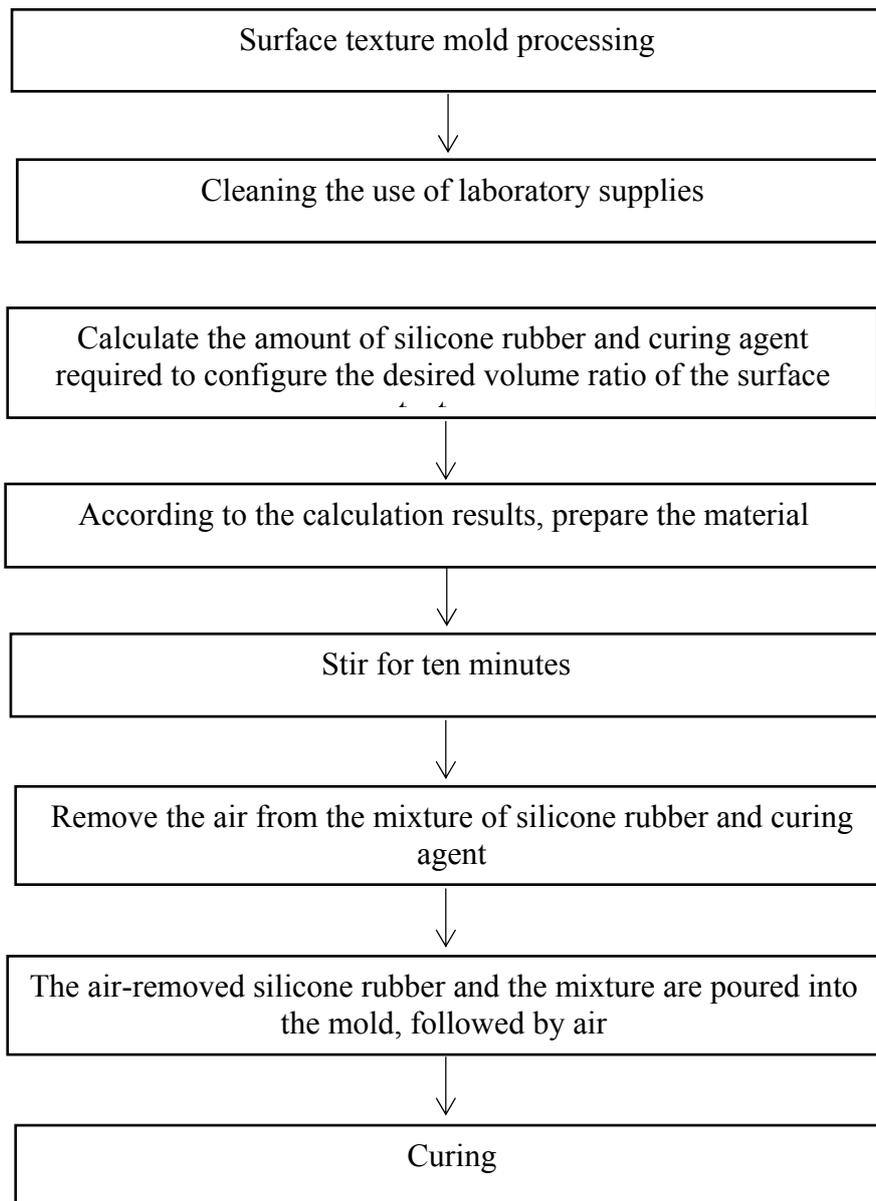
(5) Other tools

Beaker, used to hold and weigh silicone rubber; mortar for mixing silicone rubber and curing agent containers.

2.2.2 Surface texture preparation process

Surface texture of the preparation process, as shown

Table 2 Process flow diagrams



① surface texture mold processing

The material used in this paper is PLA material, the melting point is 155-185 degrees Celsius. In the production of solidworks and other drawing with the original drawing software 3D map,

save as stl format, through the software with the 3D printer into gcode code, import printer print. The machined mold is shown in the figure. The mold is used to prepare hemispherical raised textures.



Fig.5 Surface texture mold

② Cleaning

In order to ensure the accuracy and validity of the experimental data, the beaker in the laboratory, the mortar before use, should be placed in the ultrasonic cleaning machine clean, and then dried and then use.

③ Ingredients

Silicone rubber / curing agent = 10: 1

④ Weighing

The amount of the silicone rubber and the curing agent specific was calculated according to the volume ratio of the above steps, and the amount of the test material was weighed with an electronic balance, respectively.

⑤ mixing

The weighed silicone rubber and the curing agent were stirred in a mortar for 10 minutes.

⑥ In addition to bubbles

The mixture was placed in a vacuum oven and evacuated for 30 minutes to remove the bubbles. The air-separated silicone rubber and curing agent mixture into the mold, and then into the vacuum oven for ten minutes, in addition to bubbles. The purpose of vacuuming in a vacuum oven is to maximize the removal of the air mixed with the silicone rubber and the curing agent mixture during stirring to avoid a significant error in the surface texture of the surface texture.

⑦ Solidification of matrix material

Place the mixed solution mold in a vacuum o. Gradually heated to 90 °C, stay for 60 minutes,

until the completion of solidification of silicone rubber mold removed. And then remove the prepared surface texture in the mold.

2.2.3 Preparation of finished products

The surface texture of the prepared hemispherical bulge is shown in the following figure. The surface texture is tested with PVC on the test bench of the test bed.

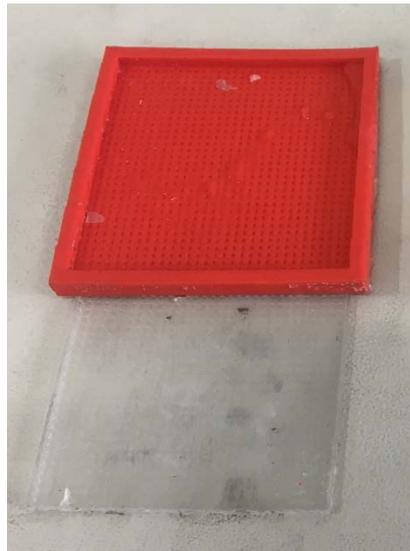


Fig.6 Hemispherical surface texture

3. EXPERIMENT AND RESULT

The prepared hemispherical texture was adhered to the upper and lower test plates of the reciprocating friction tester with PVC glue and gradually loaded, The measured frictional force is shown in the following table: unit is N.

Table 3 Frictional force

| Category\ External load(g) | 0 | 170 | 560 | 1120 | 1350 | 1912 | 2464 |
|---|--------|--------|--------|--------|--------|--------|--------|
| Both sides are textured | 0.4224 | 0.7274 | 1.4284 | 2.4414 | 2.7074 | 3.7158 | 4.6387 |
| One side is texture, the other is metal | 0.2883 | 0.5444 | 1.1133 | 1.8996 | 2.2998 | 2.9468 | 3.7158 |

From the above experimental data, it can be verified that the effect of the surface texture by 3D printing mold is obvious, so the method involved in this paper is feasible.

4. CONCLUSION

This paper provides a method for preparing surface texture, and elaborates the production process and process, and verifies its feasibility by experimental method. Its advantages are as follows:

- 1) Easy to operate, preparation time is short; proved by experiment, from the mold to the preparation of the surface texture of the preparation of only about 2 hours.
- 2) High precision; 3D printer processing of high precision molds, surface texture preparation process of mixing liquid and mold fit high.
- 3) Can make any shape of the texture, to facilitate the researchers.

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