Iron-based Powder Metallurgy Steel Collar Chemical Treatment Process Test

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Abstract. The steel collar is an important part of textile machine, which not only requires good abrasion resistance, but also have more stringent requirements for ovality and irregularities, as shown in Figure 1. Generally low carbon steel collar is carburized (or carbonitrided) after quenching to increase its surface hardness. However, in some cases, steel ring can not meet the production requirements. The greatest feature of powder is metallurgy gap and low density. But poor hardenability, large deformation and brittle hair after heat treatment, makes it a key issue.

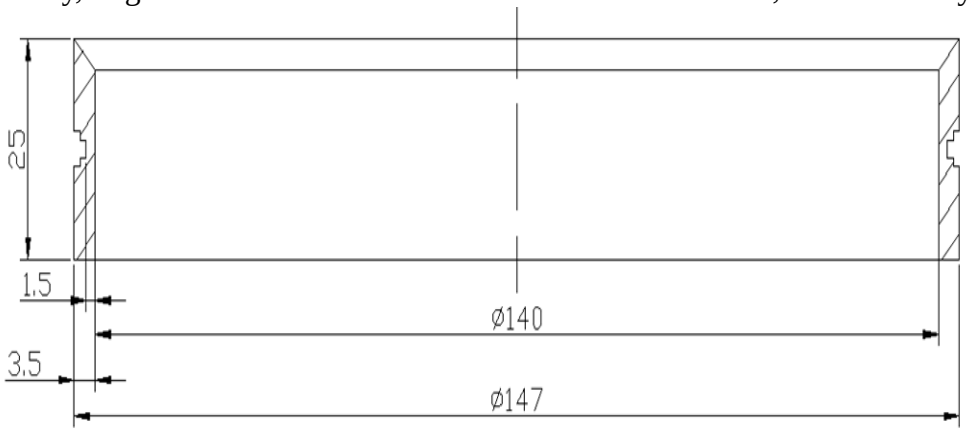

Fig. 1 schematic ring

Introduction

The ring is an important part of the textile machine, wear resistance, deformation of the surface, with stringent requirements, the use of low carbon steel carbonitriding (or carburizing) quenching improve the surface hardness and wear resistance to meet. But the gap matrix steel, high-density, large deformation and can not meet the production requirements. According to the technical requirements of the ring, we have iron-based powder metallurgy test chemical heat treatment process, and achieved good results, and through the production have proved that the process is feasible.

Heat Treatment Technology

(1) Raw materials: raw test is to provide Brothers factory, the carbon content of the iron-based powder metallurgy materials 0.1%, density before heat treatment was 6.2g/cm^3 or so, the microstructure shown in Figure 2.

(2) Carbonitriding Media: carburizing atmosphere of 50% methanol plus 50% acetone Walter cracking furnace at 920℃, and then Walter ammonia 1/3. The furnace pressure of 10 mm water column.

(3) technology test: initially the gas carburizing and nitriding heat test, but the results were not satisfactory. The main reason is too large deformation after carburizing, easy shaping, waste up to 60%. Meanwhile hardness is not uniform, can not meet the performance and quality requirements. Deformed after nitriding is also large, extremely brittle, while the hardness is low, the same can not

meet the requirements.

To solve this problem, has conducted a carbonitriding process after repeated trials, worked out at 740℃ Penetrating oil cooling can be satisfied with the result after 20 minutes, microstructure shown in Figure 3. Carbon and nitrogen at different temperatures and time permeation results shown in Table 1.

Fig.2 500×4%alcohol, nitric acid corrosion Carbonitriding organizations: martensite + graphite

Fig.3 500×4%alcohol, nitric acid corrosion materials organizations: ferrite + graphite

Tab. 1 carbonitriding temperature and time of cooling microstructure and deformation

No.	Carbonitriding temperature and time	Cool down	Gold phase tissue and deformation case
1	840℃×120 points	Oil cooler	Both surface and core part of martensite, large deformation
2	780℃×30 points	Oil cooler	Surface martensite, the center for patenting, the deformation is small
3	740℃×20 points	Oil cooler	Surface martensite, the center for patenting, the deformation is small, easy to plastic

The results after carbonitriding can meet the technical requirements of the workpiece, except we use Rockwell hardness (HRA) checks, mainly rely on metallurgical examination. Examination concluded that the hardness and density are directly related. Treated in the same furnace (740℃×20 min) in two different parts of the density, microstructure is basically the same, but the hardness values vary greatly. A density of 5.7g/cm^3 PM parts hardness HRA58~60, and a density of 6.8g/cm^3 PM parts hardness HRA70~72.

Conclusions

(1) Due to the iron-based powder metallurgy material pores large, in some cases, simply carburizing hardening is difficult to achieve the purpose of using carbonitriding can get good results.

(2) Due to the large pore powder metallurgy parts, carbon and nitrogen penetrate quickly, can lower the temperature, the deformation is reduced, time is shortened.

(3) PM after the heat treatment is directly related to the hardness and density.

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