

## (An example)

# The Results of Failure Analysis of ○○○

## 1. Introduction

This report concerns on an analysis to clear the cause of failed ○○○ that assembled in the machine.

## 2. Outline of analyzed sample

Analyzed sample : ○○○ ・ ・ ・ 1 piece

Material : JIS-SCM415

Surface treatment : carburized quenching

Operated time : about 3,000 hours

## 3. Examination items

- ( 1 ) Visual view of failed ○○○ and light fractograph
- ( 2 ) Micro fractographs by means of Scanning Electron Microscope (SEM)
- ( 3 ) Optical view of the structure
- ( 4 ) Measurement of hardness distribution

## 4. Results of each examination

- ( 1 ) Visual view of failed ○○○ and light fractograph

The visual view of failed ○○○ and light fractograph were shown in Photo 1. ○○○ was failed along the corner. The beach marks were confirmed on the fracture surface in light fractograph. It was considered that bending stress was loaded on ○○○ was indicated by light fractograph.

- ( 2 ) Micro fractographs by means of SEM

The micro fractographs on the fracture surface were shown in Photo 2. No inclusions and corrosion pits were confirmed on the origin. The striation patterns were formed in the crack propagation region.

- ( 3 ) Optical view of the structure

The optical view of the structures on the cross section though the origin were shown in Photo 3. The carburized quenching layer was confirmed in accordance with the drawing. However the network cementite was formed along the prior austenite grain boundaries and retained austenite was appeared. It was estimated that the over carburizing was carried out. Tempered martensite was normally as JIS-SCM415 was formed in the core.

- ( 4 ) Measurement of hardness distribution

The hardness distribution on the cross section though the origin was shown in Figure 1. The decrease of hardness on the carburized quenching layer was occurred due to appeared retained austenite. Normal hardness was in the core.

## 5. Conclusion

The results of each examination were carried out, it was considered that ○○○ was failed due to the load of cyclic bending stress. It was estimated that the decrease of toughness and hardness due to formed network cementite and appeared retained austenite are the major cause of failure. Therefore, the carbon potential in the furnace must be controlled during carburizing.

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