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CRACKING PARTS OF THE ROLLING BEARING

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ABSTRACT
Rolling bearings employ rolling elements /like balls or rollers/ interposed between two race ways, and relative motion is permitted by the rotation of these elements [1]. This experimental work deals with materials properties of the rolling bearing, where were investigated some cracks on the circular round after the induction hardening. Probably it is the case of bad – no optimal conditions of heat treatment especially surface hardening.
Keywords: induction quenching, rolling bearing, intergranular fracture

1. INTRODUCTION
Rolling bearings are components which make possible the relative motion of parts and the transmission of active force – characteristics – imposition of rolling parts between two relatively parts which are in motion. To advantages we can assign – low values of friction factor – its low dependency of operating conditions, good centering of shaft position, ickle consumption, easy bearing lubrication, operation ability in extremely temperature values, simply service and easily convertibility. There are also some disadvantages like big stiffness / proximate contact of rigid element of bearing, delimited period of service-especially by action of big loading and velocities, wide difference of lifetime through the identical operating condition, silence inability of beats and oscillation.
The rolling bearing are separate in accordance to profile with rolling parts: ball, tapered, cylindrical and spherical. The other contribution – radial and axial – the loading transmission is in abeam direction to the geometric axis of bearing or in axis direction of bearing.
Following the repeated cyclic stress of contact areas may occur the creation of fatigue cracks below the surface- the contact fatigue - so called pitting. This effect mostly begins on a circular round of inner ring, in consequence of noisiness and temperature increase of bearing.

2. EXPERIMENTAL PART
This experiment deals with a materials analysis of outer ring of rolling bearing, where were investigated some cracks on the circular round after the induction hardening. In order to discovery the main reason was estimated the ratio of hydrogen, measurement of hardness behaviour in surface quenching layer, evaluation of microstructure and fracture- graphic analysis. The hydrogen contain was estimated on value of 0, 30 ppm. Hardness measurement was realized by method HV5 about 1mm below the surface. Hardness value is unevenly distributed with intervals of 584 HV to 603 HV. From the hardness behaviour were specified the thicknesses of quenching layer: 2, 75 mm – area with the smallest hardness and 3, 95 mm – area with the biggest hardness.

Microstructure was evaluated on the cross-section throw the surface quenching scoring – figure 1. Depth of layer is unable, left side of scoring is value of depth of 3 to 5mm, right side of scoring has values of 2,8 – 4,5 mm. the smallest depth of quenching layer correspond to places with the smallest hardness. Microstructure of surface quenching layer is created by fine needle low tempering martensite, figure 3. Places with lower hardness – martensite allocate higher degree of tempering – figure 2. Core microstructure is created by heterogeneous sorbite which responds to enriched case, figure 4.

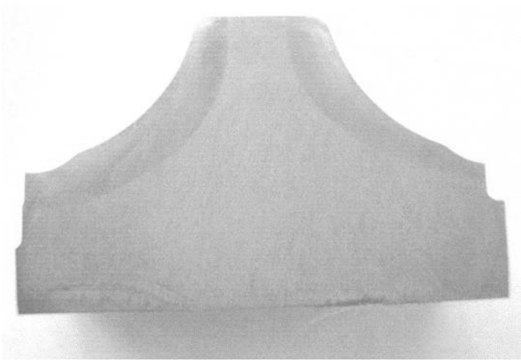

Figure 1. Surface quenching part.

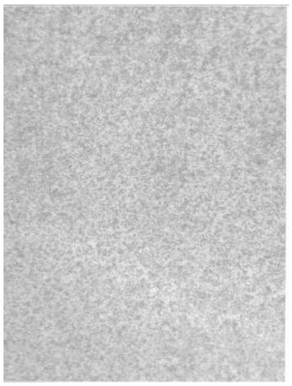

Figure 2. Micro structure of suitable area.

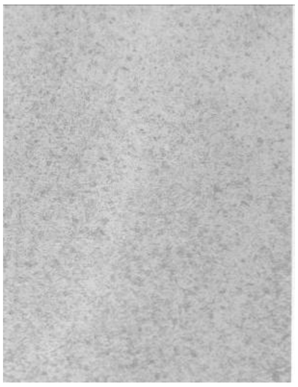

Figure 3. Micro structure of brittle area

Figure 4. Core micro structure

Microfractographic analysis was realized on REM TESLA BS 301. There was evaluate a laboratory fracture – figure 5.

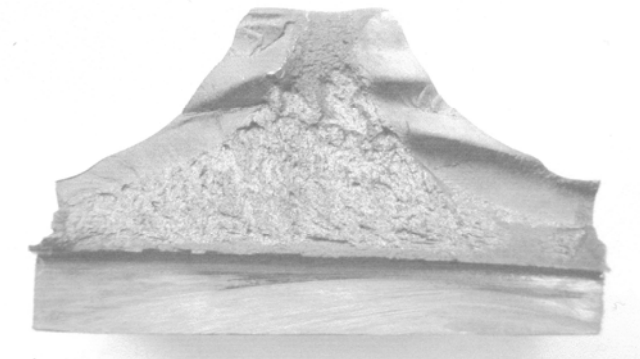

Figure 5. Fracture macro morphology

There was observing two different failure micro mechanisms in surface quenching layer. In areas with lower hardness obtain transgranular dimple fracture – figure 6; in areas with higher hardness we can see the defective brittle intergranular cleavage fracture – figure 7.

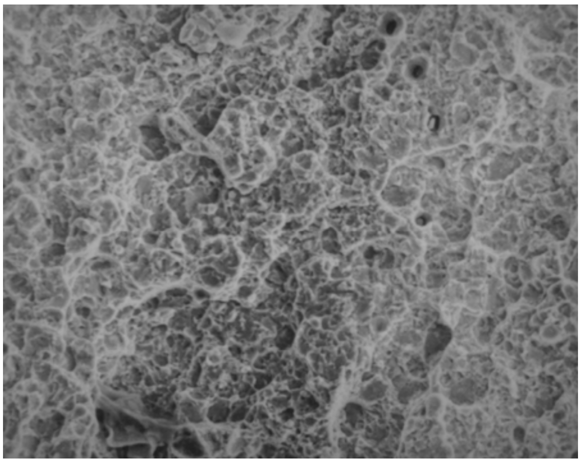

Figure 6 – Micro morphology of suitable region

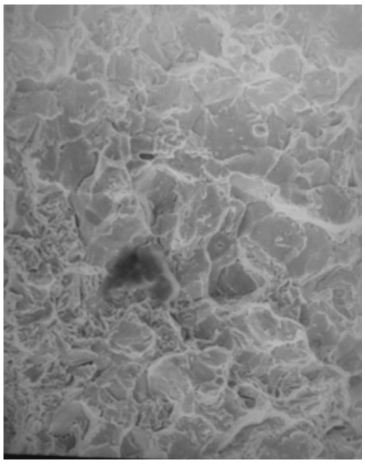

Figure 7.Micro morphology of brittle region

Transcrystalline quasi cleavage or cleavage mechanism was observing in region of core microstructure – figure 8.

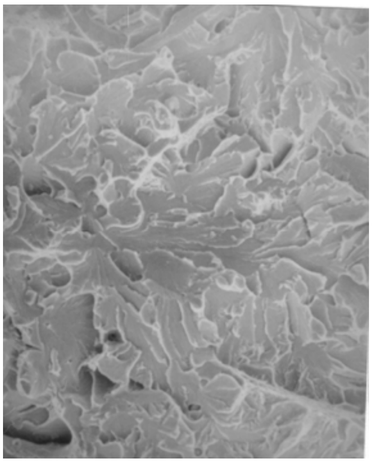

Figure 8. Core micro morphology

3. CONCLUSIONS

Following the obtained results we can allege that the reasons of cracking are inhomogeneous properties of surface quenching layer in consequence of no optimal conditions of surface hardening. Areas with brittle fracture are corresponding to areas with higher hardness. The areas with the suitable fracture respond to areas with lower hardness. Inner stresses which were created by this inhomogeneity induce cracks creation.

Heterogeneity of microstructure and material embrittlement in surface quenching layer, which were induce no optimal conditions of quenching are the main reason of cracking the outer ring of rolling bearing.

We advise to make sure the brittle fracture properties on REM by optimization of surface quenching regime, whereas the control of hardness and microstructure give uncertain useful properties of analyzed detail.

4. REFERENCES

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