2. Microfractographic examination of fractures in gray cast iron enables us to make a comparative evaluation of the tendency to brittle fracture of component blanks of gray cast iron produced by various casting methods and in different structural states. The tendency to brittle fracture is determined from the relationship between the number of segments of graphite and matrix in the fracture and from the relationship between the number of segments with viscous and brittle fracture of the matrix.

3. The presence of microcracks in the fractures of blanks of cylinder shells suggests the small extent to which the process of plastic deformation develops during their rupture.

LITERATURE CITED

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FEASIBILITY OF COMBINING THE POWER GRINDING AND SURFACE HARDENING OF COMPONENTS

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Burns are frequently formed in the surface of truck components during their power grinding after final heat treatment, for example, refinement. Thus, in grinding the outside diameter of the refined steel 40KhN2MA bolts used to secure the rocker cover, burn zones of reduced hardness to a depth of 0.020-0.025 mm are formed (Fig. 1). A tempered layer, the hardness of which is reduced from H450 to H383 is apparent at a depth of 0.04-0.05 mm from metallographic analysis of the bolts. A layer of secondary hardening with an increased hardness (to H457) beyond which again follows a tempered layer right up to a distance of 0.3 mm from the surface is observed in the zone of significant metal overheating, which is located at a depth of 0.05 mm.

As one proceeds from the surface, the hardness increases to that of the center of the components.

A similar law was also observed for the longitudinal power grinding of a steel 45 clamp of a Y-coupling in a truck engine. After grinding, a layer up to 2.5 mm thick, which was preliminarily hardened by casehardening, was fully tempered. Variation of grinding conditions and replacement of the shaping wheels did not produce positive results.

The depth of the tempered zone could be reduced only by a significant reduction in the longitudinal feed of the grinding wheel.

The formation of similar burns during grinding is explained by the fact that at the point of contact between the grinding wheel and the surface of the component, the surface may be heated to temperatures above 900°C. In this connection, we made an attempt to combine the operation of longitudinal power grinding with surface hardening of the Y-coupling clamp by the heat liberated on the surface of the component during grinding.

During longitudinal grinding with a large-diameter wheel and a significant grinding depth (>0.5 mm), the holding time at temperatures exceeding the critical reaches several seconds; this is sufficient time for a transformation to take place. In this case, the grinding fluid (GF) is fed onto heated surface layer a—a' (Fig. 2) only after passage of the grinding wheel and exposure of the contact zone. In grinding a component with a wheel having a diameter D and removing a layer of thickness h, heating of the transverse layer occurs when the wheel travels a distance S from the moment of its contact with the transverse layer to the moment of its emergence at a longitudinal feed rate vcr:

\[ S = \sqrt{\left(\frac{D}{2}\right)^2 - \left(\frac{D}{2} - h\right)^2} = \sqrt{Dh - h^2}. \]  

(1)

If we neglect the subtrahend in the radicand,

\[ S = \sqrt{Dh}. \]  

(2)
The heating time of the transverse layer can be represented as

\[ \tau = \frac{\sqrt{D h_c}}{a_{cr}}. \]  

For a wheel diameter of 500 mm, a grinding allowance of 1 mm, and a feed rate of 10 mm/sec, the heating time of the transverse layer is 2.2 sec. The duration and rate of the grinding-fluid feed (quenching medium) can also be regulated.

Each transverse layer of the component being ground is cooled gradually as the wheel advances after a certain delay. Where the size of the slit required for infiltration of the fluid is 0.2 mm, for example, the holding time is 1 sec for a wheel diameter of 500 mm and a longitudinal feed of 10 mm/sec.

The amount of heat liberated in grinding is proportional primarily to the thickness of the layer being removed (allowance) and the longitudinal feed. The greater the allowance and wheel diameter, the deeper the heating of the components and the greater the thickness of the hardened layer. An increase in the feed above and beyond the optimal leads to a decrease in the heating time and in the thickness of the hardened layer.

Fig. 1. Hardness distribution in burn zone after grinding refined component (h is distance from surface).

Fig. 2. Diagram showing longitudinal grinding: 1) component being machined; 2) grinding wheel.

Fig. 3. Microstructure of casehardened layer obtained from grinding. ×1000.

Fig. 4. Variation in microhardness through thickness of surface layer (h is distance from surface): 1, 2) grinding-fluid consumption of 60 and 30 liters/min, respectively.